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9730

I N D E X

Page

WITNESSES ON BEHALF OF THE DEFENDANTS

STEVEN LARSON

| | |
|--|------|
| Continued Direct Examination by Mr. McDaniel | 9731 |
| Cross-Examination by Mr. Garren | 9750 |

BILLY R. CLAY, DVM.

| | |
|----------------------------------|------|
| Direct Examination by Mr. Tucker | 9802 |
|----------------------------------|------|

1 Tuesday, January 5, 2010

2 * * * * *

3 MR. MCDANIEL: Morning, Your Honor.

4 THE COURT: Good morning. Mr. Daniels,
5 you may resume.

6 MR. MCDANIEL: Thank you.

7 **CONTINUED DIRECT EXAMINATION**

8 **BY MR. MCDANIEL:**

9 Q. Good morning, Mr. Larson.

10 A. Good morning.

11 Q. When we ended yesterday, we had just finished
12 talking about Defendants' Joint Exhibit 1629 which is
13 figure 6 to your report, the histogram displaying the
14 distribution of ratios of phosphorus to copper
15 comparing the edge-of-field samples to the water well
16 samples; right?

17 A. The ratio of copper to phosphorus, yes.

18 Q. Right. Did you use this analytical technique
19 for any of the other key constituents that Dr. Fisher
20 used in his analysis?

21 A. Yes. I also did the same evaluation using
22 the ratios of zinc to phosphorus.

23 Q. All right. Would you look, sir, at what's
24 been marked for identification as Defendants' Joint
25 1630 and identify that for the record?

1 A. Yes. This is a figure that I prepared for my
2 report.

3 Q. Okay. Figure 7 from your report?

4 A. Yes.

5 Q. Sir, was this figure based upon Dr. Fisher's
6 data?

7 A. Yes, it was.

8 Q. Was the figure prepared by you or under your
9 direction?

10 A. Yes, it was.

11 MR. MCDANIEL: Your Honor, defendants
12 offer Defendants' Joint Exhibit 1630 for admission.

13 MR. GARREN: No objection, Your Honor.

14 THE COURT: 1630 is admitted.

15 Q. (BY MR. MCDANIEL) All right, Mr. Larson.
16 Would you explain, please, your figure 7, Defendants'
17 Joint Exhibit 1630, what you're portraying for the
18 court here?

19 A. Well, as with the figure associated with the
20 ratios of copper to phosphorus, I made the same
21 calculations for each of the different samples for the
22 ratio of zinc to phosphorus. On this figure, I've
23 displayed the results of those ratios for two
24 different groups, the edge-of-field samples in red and
25 for the groundwater well samples in blue.

1 Again, this is a histogram where I group the
2 results; that is, the different ratios, into different
3 categories as shown by the horizontal axis. Then
4 based on the count of the number of samples that are
5 within that group, I calculate the frequency of
6 occurrence, which is the vertical axis, and plot them
7 and that plots as a histogram, and you can see the
8 distribution and central tendency then of the ratios.
9 That's what the diagram shows, the edge-of-field
10 distribution in red and the groundwater well samples
11 distribution in blue.

12 Q. So this analysis, what does it tell you about
13 the relationship or differences between these two
14 groups of samples, if anything?

15 A. Well, you can see that the groundwater well
16 samples, in terms of the central tendency and majority
17 of the ratios computed for zinc to phosphorus there,
18 are displaced to the right of the edge-of-field sample
19 distribution. The central tendency of that is
20 generally down in the range of .03 to .1. With
21 respect to the groundwater well samples, the central
22 tendency is in the range of .3 to 1.

23 So there's over an order of magnitude
24 difference between the central tendency of the two
25 distributions, and so you can then see the difference

1 in the distributions of those results. The conclusion
2 is that the distributions are different, significantly
3 different.

4 Q. All right, sir. In the course of your
5 testimony yesterday and what we've just gone through
6 with the second histogram, you've described two
7 different types of analyses you did by looking -- by
8 plotting on a linear fashion the relationships between
9 Dr. Fisher's constituents and the different media as
10 one technique that you used and the second technique
11 being using these histograms to look at the
12 distribution of the relationships.

13 Based upon these two types of analyses, did
14 you form an opinion as to whether or not Dr. Fisher
15 had shown that groundwater samples were related to the
16 edge-of-field samples?

17 A. Yes, I did.

18 Q. What is that opinion?

19 A. That these data do not demonstrate a
20 relationship between the edge-of-field samples and the
21 groundwater samples.

22 Q. Did you form any opinion as to whether or not
23 Dr. Fisher's fingerprint ratio analysis can support
24 any conclusion about the source of any constituents in
25 the groundwater in the Illinois River Watershed?

1 MR. GARREN: Judge, I want to object to
2 this. Both it mischaracterizes the word
3 "fingerprinting" as used by Dr. Fisher, which he did
4 not use, and it's misleading and very prejudicial.
5 That word does not appear anywhere in Dr. Fisher's
6 report nor in his testimony.

7 THE COURT: Any response?

8 MR. MCDANIEL: Well, I can rephrase the
9 question --

10 THE COURT: Very well. If you would.

11 MR. MCDANIEL: Thank you.

12 Q. (BY MR. MCDANIEL) All right. Reask the
13 question then, Mr. Larson.

14 Did you form any opinion as to whether or not
15 Dr. Fisher's ratio analysis using arsenic, copper,
16 zinc, and phosphorus can support any conclusion that
17 the source of any constituents -- excuse me -- can
18 support any conclusion about what is the source of any
19 constituents in the groundwater in the Illinois River
20 Watershed?

21 A. Yes, I did.

22 Q. And what's that opinion?

23 A. That these data do not support such a
24 conclusion.

25 Q. Did you perform any other analysis using the

1 plaintiff's data to test the hypothesis that poultry
2 litter use has caused an impact to groundwater in the
3 Illinois River Watershed?

4 A. Yes, I did.

5 Q. And what was that?

6 A. Well, in some of the work conducted by
7 Dr. Olsen, there were analyses that attempted to
8 portray -- or that portrayed the relationship between
9 sample results -- in his case surface water samples --
10 and poultry house density.

11 The concept generally seemed to be that if
12 you saw an increasing trend in the concentrations with
13 poultry house density that was significant, that that
14 was an indication that there was a link between
15 poultry litter and the concentrations found in the
16 samples. And although I don't believe that that
17 relationship is as simple as that, I wanted to test
18 whether or not the groundwater data would exhibit such
19 a relationship.

20 Q. All right. So let's be clear about what you
21 did and what you didn't do.

22 You testified that you're aware that
23 Dr. Olsen has testified about some relationship
24 between the supposed poultry house density and surface
25 water quality parameters. Did you look at that aspect

1 of Dr. Olsen's analysis?

2 A. In his report, yes, I did.

3 Q. Well, what I mean is, are you here to
4 critique or offer opinions in rebuttal to that aspect
5 of Dr. Olsen's analysis?

6 A. No.

7 Q. All right.

8 A. No.

9 Q. Now, what did you use for the poultry house
10 density data that you considered in your analysis?

11 A. I used data that we obtained from Dr. Olsen's
12 materials that related poultry house density to the
13 different sampling locations.

14 Q. Are you contending, sir, that Dr. Olsen's
15 poultry house density data is correct or reliable?

16 A. No, I'm not.

17 Q. Well then, why did you use it?

18 A. Because I wanted to test the concept that
19 they had to see if, in fact, the groundwater data
20 would show such a relationship.

21 Q. All right, sir. Would you look at what's
22 been marked for identification as Defendants' Joint
23 1633 and identify that, please?

24 A. Yes. This is a graph that I prepared for my
25 report.

1 Q. Is this figure 10 from your report?

2 A. Yes, it is.

3 Q. Where did the data come from that was used to
4 generate this figure, sir?

5 A. The data for active poultry house density
6 associated with the different samples was taken from
7 Dr. Olsen's materials, and the data on the
8 concentrations of the different constituents were
9 taken from the data we obtained from the plaintiffs,
10 the CDM data.

11 Q. All right. Was this figure prepared by you
12 or under your direction?

13 A. Yes, it was.

14 MR. MCDANIEL: Your Honor, defendants
15 offer Defendants' Joint Exhibit 1633 for admission.

16 THE COURT: Any objection?

17 MR. GARREN: No objection.

18 THE COURT: 1633 is admitted.

19 Q. (BY MR. MCDANIEL) All right, Mr. Larson. If
20 you could please, sir, explain the elements of this
21 figure for the court.

22 A. Well, what I've plotted is, along the
23 horizontal axis, I've plotted the value of the poultry
24 house density in houses per square mile that I
25 obtained from Dr. Olsen's information for each of the

1 sampling locations. And on the vertical axis, I
2 plotted the total dissolved phosphorus concentration
3 associated with each of those samples so that I could
4 look at the distribution of those concentrations as it
5 relates to the poultry house density. And that's
6 what's shown by each of the red circles.

7 Q. When we were looking at your previous linear
8 plots that were plotted on the logarithmic scale, you
9 said you could not display the nondetect results on
10 those figures.

11 Are nondetect results portrayed on this
12 figure?

13 A. Yes, they are.

14 Q. All right. How would we identify those?

15 A. Well, if you look over at the far-left axis
16 under zero, you'll see a distribution of red points
17 basically going up the vertical axis. Those would
18 represent non -- or indicate nondetects for the -- or
19 I'm sorry -- the zero, the line there, would represent
20 locations where the active poultry house density value
21 was zero.

22 If you go along the horizontal axis, you will
23 see locations where the total dissolved phosphorus
24 concentration was below the detection limit, and it's
25 plotted on the zero line along with its corresponding

1 value for the poultry house density.

2 Q. All right, sir. Did you undertake with this
3 data a regression analysis or an analysis to determine
4 the best-fit line for the data?

5 A. Yes. I looked at the degree of linear
6 correlation between the two variables.

7 Q. And how is that reflected on the figure?

8 A. It's reflected by the solid line you see
9 sloping downward from left to right, and the
10 statistics associated with that line are shown inside
11 the box.

12 Q. All right. What did you determine was the R^2
13 for the relationship between the plaintiff's active
14 poultry house density and total dissolved phosphorus?

15 A. It was .0099.

16 Q. All right. I notice on the legend on the
17 phosphorus scale you have in parenthesis "4500PF."

18 A. Yes.

19 Q. Would you tell us what that means?

20 A. That's the particular method for analyzing
21 the phosphorus that were used for this set of data.

22 Q. And why did you use the 4500PF data?

23 A. Well, generally speaking, that method has a
24 lower detection limit than some of the other methods
25 and is, I guess, oftentimes a preferred method. So

1 that's why I plotted that information.

2 Q. Did Dr. Olsen indicate, in either his
3 testimony or his report, his own view of a
4 preferential method for analyzing for phosphorus?

5 A. Yes. In his report, he described the various
6 methods and this one seemed to be his preferred
7 method.

8 Q. All right, sir. When you see a linear -- or
9 a fit line like we see in your figure, Exhibit 1633,
10 that slopes downward from left to right, what does
11 that indicate?

12 A. Well, the line would suggest, for what it's
13 worth, that as active poultry house density increases
14 the concentration -- the dissolved concentration of
15 phosphorus actually decreases. However, the
16 statistical significance of that line is very, very
17 low. Consequently, from a statistical viewpoint, it
18 could just as easily be zero because of the low value
19 of R^2 that you see. So there really isn't any
20 relationship that the statistics can detect.

21 Q. From this analysis, sir, did you draw any
22 conclusions about the existence of any relationship
23 between dissolved phosphorus concentrations in the
24 water well samples and where those samples were taken
25 as it relates to active poultry house density?

1 A. The conclusion that I drew -- yes, I did draw
2 a conclusion.

3 Q. Tell us what that is.

4 A. And that conclusion is -- and you can sort of
5 see it just by looking at the scatter of the data --
6 that there isn't any significant definitive
7 relationship between increasing poultry house density
8 and the concentrations found in the groundwater well
9 samples.

10 Q. All right. Did you do a similar analysis for
11 any of the constituents other than dissolved
12 phosphorus?

13 A. Yes. I also looked at other constituents.

14 Q. All right, sir. Would you pull out and look
15 at what's been marked for identification as
16 Defendants' Joint 1634 and identify that for the
17 record?

18 THE COURT: Did Dr. Fisher do a similar
19 analysis regarding the relationship between poultry
20 house density and groundwater?

21 THE WITNESS: Not that I know of, no.

22 THE COURT: Now, have you ever done any
23 work with regard to groundwater sampling in karst
24 topography?

25 THE WITNESS: To some degree, yes.

1 THE COURT: All right. And you
2 understand that with the fracturing and the limestone
3 it presents some complexity?

4 THE WITNESS: Yes, it does. Most
5 groundwater systems have some degree of complexity.

6 THE COURT: Right.

7 THE WITNESS: On the other hand, even in
8 karst topography where you have fractures, groundwater
9 flow is still driven by the water level conditions
10 that you have. So you've got to be a little cautious
11 about what fracturing means when you look at these
12 kinds of conditions. Because at first blush it often
13 gives you the indication that you can have rapid flow,
14 and it's possible you could, but it's also driven by
15 the water -- the amount of water that's actually going
16 through the system. If that amount is relatively low,
17 you may have actually relatively slow movement.

18 Also, when you look at it on a broader scale,
19 obviously there are networks of these fractures, and
20 many times the smaller network of fractures is
21 the -- is more of a significant factor when you look
22 at water wells, for example, because you may not be
23 intersecting, let's say, a major fracture necessarily.

24 THE COURT: Thank you. Go ahead.

25 Q. (BY MR. MCDANIEL) All right, Mr. Larson. I

1 think -- let's go back, sir, and ask you again: Have
2 you pulled out what's been marked for identification
3 as Defendants' Joint 1634?

4 A. Yes, I have.

5 Q. All right. Identify that, please.

6 A. Well, this is a figure that I prepared for my
7 report.

8 Q. Is it figure 11 from your report?

9 A. Yes.

10 Q. What was the source of data for this figure?

11 A. The data for this was the poultry house
12 density values that I obtained from Dr. Olsen's
13 materials and the concentrations of dissolved copper
14 from the CDM database.

15 Q. All right. Was the figure either prepared by
16 you or under your direction?

17 A. Yes, it was.

18 MR. MCDANIEL: Your Honor, defendants
19 offer for admission their Joint Exhibit 1634.

20 MR. GARREN: No objection.

21 THE COURT: 1634 is admitted.

22 Q. (BY MR. MCDANIEL) All right, sir. I think
23 based upon your explanation of the prior figure, we
24 understand how you structured the figure.

25 Can you tell us which constituents you

1 evaluated here and what that analysis shows?

2 A. This compares the dissolved copper
3 concentrations to the active poultry house density at
4 each of the sample locations. And, again, visually
5 you can see that the data are just generally
6 scattered, there's no apparent trend. And as you can
7 see from the statistics, that's what the statistics
8 also show, that there's no apparent trend in the data.

9 Q. And did you calculate the R^2 for your
10 best-fit line?

11 A. Yes, I did.

12 Q. And what was that?

13 A. .0125.

14 Q. And what does that tell you, sir?

15 A. Indicates a very low degree of linear
16 correlation. Basically, these results would show that
17 there's no apparent linear correlation.

18 Q. And you may have stated this in your prior
19 answer and it may have escaped me: What constituent
20 were you comparing to the plaintiff's active poultry
21 house density figures here?

22 A. Dissolved copper in the groundwater well
23 samples.

24 Q. All right, sir. From this analysis, did you
25 draw any conclusions?

1 A. Yes.

2 Q. And what was that?

3 A. That when you look at the dissolved copper
4 concentrations relative to the poultry house density,
5 there's no apparent increasing trend in concentration
6 with poultry house density.

7 Q. All right, sir. Did you undertake the same
8 analysis to look at arsenic concentrations?

9 A. Yes, I did.

10 Q. All right. Would you pull out and look at
11 what's been marked for identification as Defendants'
12 Joint 1635 and identify that?

13 A. This is another figure that I prepared for my
14 report.

15 Q. Figure 12 from your report?

16 A. Yes.

17 Q. All right, sir. And the source of this data,
18 is it the same as your prior answer?

19 A. Yes.

20 Q. All right. Was the figure prepared by you or
21 under your direction?

22 A. Yes, it was.

23 MR. MCDANIEL: Your Honor, defendants
24 offer Defendants' Joint Exhibit 1635 for admission.

25 MR. GARREN: No objection.

1 THE COURT: 1635 is admitted.

2 Q. (BY MR. MCDANIEL) All right. Dr. Larson,
3 tell us about this analysis, what you analyzed and
4 what you found.

5 A. Here, I've compared the arsenic
6 concentrations to -- or related the arsenic
7 concentrations to the poultry house density. You can
8 see a lot of red dots along the horizontal axis. That
9 means that the concentration in the sample was below
10 the detection limits, and so you can see a lot of the
11 concentrations found in the water well samples were
12 below the detection limits. But, again, both visually
13 and statistically you can see there's no apparent
14 trend in the data.

15 Q. And this is the arsenic -- dissolved
16 arsenic?

17 A. Correct.

18 Q. All right, sir. Did you calculate the R^2 for
19 the best-fit line for this data?

20 A. Yes, I did.

21 Q. What was the result?

22 A. .0041.

23 Q. And what does that tell you?

24 A. It indicates a very low degree of linear
25 correlation basically as a practical matter showing no

1 apparent linear correlation.

2 Q. And, finally, did you -- did you use this
3 same technique to look at the dissolved zinc
4 concentrations?

5 A. Yes, I did.

6 Q. All right then. Would you pull out, please,
7 what's been marked for identification as Defendants'
8 Joint 1636 and identify that?

9 A. This is a figure that I prepared for my
10 report.

11 Q. Figure 13 from your report?

12 A. Yes.

13 Q. Is the source of the data the same, sir?

14 A. Yes.

15 Q. All right. Was this figure prepared by you
16 or under your preparation -- or under your
17 direction?

18 A. Yes, it was.

19 MR. MCDANIEL: Your Honor, defendants
20 offer their Joint Exhibit 1636 for admission.

21 MR. GARREN: No objection.

22 THE COURT: 1636 is admitted.

23 Q. (BY MR. MCDANIEL) All right, sir. Would you
24 please explain on this figure what you did comparing
25 the plaintiff's active poultry house density

1 information to the dissolved zinc concentrations?

2 A. As with the other diagrams, I plotted the
3 zinc versus the poultry house density. They're shown
4 by the red dots. You can visually look at the scatter
5 in the data values and there's no apparent trend.
6 That also is indicated by the statistics that you see
7 in the -- inside the box.

8 Q. All right, Mr. Larson. In summary, using the
9 plaintiff's data, did you determine whether or not any
10 correlation can be drawn between the plaintiff's
11 poultry house density data and these constituents in
12 groundwater?

13 A. I did.

14 Q. And what is that opinion?

15 A. That there was no apparent correlation
16 between those two variables.

17 Q. Mr. Larson, does the data establish any
18 cause-and-effect relationship between poultry house
19 density and any of the constituents identified in the
20 groundwater samples collected by CDM?

21 A. No.

22 MR. MCDANIEL: I pass the witness, Your
23 Honor.

24 THE COURT: Cross-examination.

25 MR. MCDANIEL: I'm sorry.

1 (Discussion held off the record)

2 MR. MCDANIEL: Pass. Sorry.

3 MR. GARREN: One second, Your Honor.

4 Good morning, Your Honor.

5 THE COURT: Good morning.

6 **CROSS-EXAMINATION**

7 **BY MR. GARREN:**

8 Q. Mr. Larson.

9 A. Morning.

10 Q. Let me establish a few things about yourself
11 and then we'll move into some more substantive
12 matters.

13 First off, you agree you're not a geochemist;
14 correct?

15 A. That's correct. I'm not a geochemist.

16 Q. And you don't hold yourself out as a
17 statistician, do you?

18 A. No. I use statistics frequently in my work
19 but I'm not a statistician.

20 Q. Is it true and you agree that any experience
21 regarding the study of runoff, infiltration, or
22 leaching of poultry waste constituents is not part of
23 your curriculum vitae?

24 A. Yes, that's correct.

25 Q. Is it true that you have not worked on

1 matters specifically involving the contamination from
2 animal waste?

3 A. I think when you -- I think that's correct
4 when you look at it specifically animal waste.

5 Q. And it's true that in this case, you have not
6 studied the issue of runoff from fields where poultry
7 waste has been land-applied; correct?

8 A. That's correct.

9 Q. And have you conducted any study or
10 investigation in order to form an opinion whether or
11 not poultry waste when land-applied in the IRW will
12 leach into the soil?

13 A. I haven't formed an opinion one way or the
14 other.

15 Q. And so you've not conducted any study or
16 investigation either; correct?

17 A. That's correct.

18 Q. Have you conducted any study or investigation
19 in order to form an opinion whether or not poultry
20 waste when land-applied in the IRW will leach through
21 the soil and into the groundwater?

22 A. No. I've only looked at the sampling data
23 that I presented in my testimony.

24 Q. Have you conducted a study or investigation
25 as to whether land-applied poultry waste is a source

1 of groundwater contamination in the IRW?

2 A. Only to the extent that I've looked at the
3 relationships in the data that I examined, and my
4 conclusion there was that there was not any indication
5 in that data that that was an impact.

6 Q. But you've not conducted your own study or
7 investigation creating your own data to do that
8 either; correct?

9 A. That's correct.

10 Q. You do agree, though, that based upon your
11 review of the literature, that waste, poultry waste
12 specifically, can be a source of groundwater
13 contamination, do you not?

14 A. It has the potential to be, yes.

15 *(Discussion held off the record)*

16 Q. *(BY MR. GARREN)* Now, Mr. Larson, it's also
17 true that you have not investigated whether
18 nonpoint-source pollution can accelerate
19 eutrophication of waterbodies?

20 A. That's correct.

21 Q. Have you conducted any scientific study or
22 investigation in the IRW to determine groundwater flow
23 patterns?

24 A. I haven't conducted a specific study. I've
25 reviewed information just generally about the

1 groundwater conditions in the basin.

2 Q. Have you -- or has any other defense expert,
3 to your knowledge, conducted a scientific study as to
4 the investigation in the IRW for groundwater flow
5 patterns?

6 A. I can't testify as to every expert but --

7 Q. Are you aware of any is my question?

8 A. Oh, I'm sorry. I'm not.

9 Q. And you're familiar with a company called
10 "Apex"?

11 A. Uh-huh. Yes.

12 Q. And did Apex conduct any scientific study or
13 investigation to determine groundwater flow patterns
14 in the IRW?

15 A. Not that I'm aware of, no.

16 Q. Is it true, sir, that you or others have not
17 conducted any sampling at the location of the sites
18 that you visited in the IRW?

19 A. That's correct. Or at least I didn't take
20 any samples.

21 Q. All right. And when we say you didn't take
22 samples, that would include soil sediment or water;
23 correct?

24 A. That's correct.

25 Q. For your work in this case, did you conduct a

1 traditional fate and transport study regarding
2 phosphorus in the IRW?

3 A. I did not conduct a specific fate and
4 transport analysis. I did review the sampling data as
5 I've indicated in my testimony.

6 Q. You've testified that you have modeling
7 experience, much which you learned with and through
8 USGS; correct?

9 A. That's correct.

10 Q. And you did not perform any modeling for this
11 case regarding contamination from poultry waste, did
12 you?

13 A. I did not perform any modeling, no.

14 Q. Specifically, with regard to some of your
15 opinions about septic tanks, you did not perform any
16 modeling with regard to the constituents from septic
17 tanks; correct?

18 MR. MCDANIEL: Excuse me, Your Honor.
19 We didn't offer any testimony about septic tanks on
20 the record.

21 MR. GARREN: That's fine. It was in his
22 report. I had it outlined. I'll move on, Judge.

23 THE COURT: Thank you.

24 Q. (BY MR. GARREN) Let's talk about your
25 appearances in the IRW.

1 It's true you have visited the IRW basically
2 a single trip in July of 2008 for approximately the
3 better part of two days; correct?

4 A. That's correct.

5 Q. And that trip was simply to accompany
6 representatives of that company called "Apex" to
7 various sites; correct?

8 A. That's correct.

9 Q. And you didn't accompany them to all of the
10 sites but some of them; correct?

11 A. That's correct.

12 Q. And you've testified you didn't take samples.
13 It's my understanding in our discussions in your
14 deposition that you did suggest they take pictures for
15 you; is that true?

16 A. I did recommend, I guess, in the discussions
17 about their protocol that they -- that they take
18 photographs of the areas surrounding the sites.

19 Q. All right. As I understand then today as
20 part of this trial, you're not giving any opinions
21 with regard to septic tanks and their effect that they
22 may have on groundwater in the IRW; correct?

23 A. That's correct.

24 Q. All right. Now, in response to a couple
25 questions that the judge asked you, you talked about

1 fracturing. It is true in the IRW that there can be
2 both vertical and horizontal "fractioning"; correct?

3 A. Fracturing, yes.

4 Q. All right. And that fracturing does, in
5 fact, allow groundwater to move both laterally and
6 vertically; correct?

7 A. That's correct. The predominant movement in
8 the groundwater tends to be lateral but there's also
9 vertical movement.

10 Q. Okay. And so to some degree then, what we're
11 talking about here is that water is dependent upon the
12 gradient; correct?

13 A. The directions and rate of flow will be a
14 function of the water level gradient.

15 Q. Okay. Let's talk about the watershed. You
16 agree that the Springfield Plateau aquifer is present
17 in the IRW?

18 A. Yes.

19 Q. And how do you know that?

20 A. By reviewing various reports describing the
21 geology of the area.

22 Q. And those reports are -- you're not talking
23 about reports from the plaintiff's work, but like
24 peer-reviewed or other types of articles?

25 A. Yeah. Generally other types of reports.

1 Q. Did you know that information before you got
2 into this case?

3 A. I probably did. I had done some work in
4 southwestern Missouri previously and so generally I
5 was familiar with that.

6 Q. Okay. And the Springfield Plateau is
7 referred to as an unconfined aquifer; correct?

8 A. Yes. For the most part, I think that's true.

9 Q. All right. And you would agree that an
10 unconfined -- the unconfined nature of what is that
11 Springfield plateau aquifer that flows in the IRW make
12 it susceptible to impacts from surface and near
13 surface sources of contamination?

14 A. Yes. I think in general the unconfined
15 nature of any aquifer makes it susceptible to sources
16 of surface contamination.

17 Q. Now, is it correct in my understanding, sir,
18 that the water table actually can occur within this
19 aquifer, what we referred to as the Springfield
20 Plateau?

21 A. That's the definition of an unconfined
22 aquifer, is that the water table is contained within
23 the aquifer.

24 Q. And that is because that aquifer is really
25 the closest or nearest to the surface; correct?

1 A. Yes.

2 Q. Being the nearest to the surface of the IRW,
3 that would be a predominant reason for its
4 susceptibility to contamination; do you agree?

5 MR. MCDANIEL: Excuse me, Your Honor.
6 Since we were talking principles, now we're talking
7 about the IRW, we didn't cover any of this on direct.
8 We didn't offer his assessments of the geology or
9 hydrogeology specifically in the IRW on direct. He
10 spoke specifically to the analytical data. So I think
11 it's outside the scope.

12 MR. GARREN: My response would be, Your
13 Honor, these are certainly important premises and the
14 understanding of his knowledge of this watershed, for
15 him to take data and do his analysis on it and draw
16 opinions only from data that was gathered by others.

17 THE COURT: I understand. The
18 objection's overruled.

19 Go ahead.

20 A. Could you repeat the question?

21 Q. (BY MR. GARREN) Yes. Is the unconfined
22 nature of the aquifer in the IRW near the surface a
23 predominant reason for its susceptibility to
24 contamination?

25 A. Well, I think, as I testified, the unconfined

1 nature of any aquifer makes it potentially susceptible
2 to surface contamination.

3 Q. Okay. And you mentioned, in response to
4 questions to the judge, that the fracturing and the
5 solution openings that essentially exist in the IRW do
6 allow for some rapid water transfer or transport;
7 correct?

8 A. It can happen from place to place. I think
9 you have to be a little cautious, as I indicated to
10 the -- to the judge, that it's controlled by where
11 water comes from and where it goes and water level
12 gradient. So it isn't as simple as just having
13 fractures.

14 Q. Do you know what kind of construction the
15 wells are in the IRW? Did you investigate that?

16 A. I didn't investigate it in detail. My
17 general understanding is they're cased down --
18 generally cased down to certain depths and then open
19 holes below those depths.

20 Q. And so we would refer to that as an open
21 borehole-type construction with some casing at the
22 top?

23 A. Correct.

24 Q. Okay. And you would agree that the open
25 borehole allows mixing of groundwater from multiple

1 horizontal conduits in the IRW?

2 MR. MCDANIEL: Your Honor, asking him
3 about well construction, and specifically in the IRW,
4 is not within the scope of his testimony. So --

5 MR. GARREN: If may respond, Your
6 Honor.

7 THE COURT: Go ahead.

8 MR. GARREN: The opinions that he's
9 giving are predicated on the flow of water. As you
10 understand that his opinions deal with the
11 groundwater, I think it's important to understand how
12 that groundwater operates, how it reacts, and when
13 you're collecting it in a well, the construction of
14 that well and how it interacts with these fractures
15 and the movement of subsurface waters would be
16 important.

17 THE COURT: Well, I'll give you some
18 latitude here, although I don't know that it's been
19 established that this portion of northeastern Oklahoma
20 is an area where we have a lot of open boreholes. But
21 I understand.

22 Go ahead.

23 MR. GARREN: We have collection from
24 wells -- sampling from wells and that's -- and that's
25 why I asked him whether or not he had any knowledge

1 about the construction.

2 THE COURT: All right. Overruled.

3 A. Could you repeat the question, please?

4 Q. (BY MR. GARREN) Yeah. I may ask you
5 differently here. Just a second.

6 Is it true that with an open borehole well
7 that this can allow for mixing of groundwater from
8 multiple horizontal conduits in the IRW?

9 A. Well, with any well, whether it's an open
10 borehole or whether it has a screen in it, when you
11 pump water out of that well the water that comes to
12 the well as a consequence of that pumping will be
13 distributed throughout the interval of either the
14 screen or the open borehole depending on the relative
15 hydraulic conductivities outside the borehole areas.
16 Higher hydraulic conductivity will tend to contribute
17 more water, areas of lower hydraulic conductivity will
18 tend to contribute less water.

19 Q. It's true and you agree, do you not, sir,
20 that surface water and groundwater in the IRW
21 interact, they can be one in the same?

22 A. I wouldn't consider them one in the same.
23 There are certainly areas where they do interact.

24 MR. GARREN: May I approach, Your Honor?

25 THE COURT: You may.

1 Q. (BY MR. GARREN) Mr. Larson, I've handed you
2 an article, a published paper, by James Adamski
3 entitled: "Geochemistry of the Springfield Plateau
4 Aquifer of the Ozark Plateaus Province in Arkansas,
5 Kansas, Missouri and Oklahoma, USA."

6 Have you seen this paper before, sir?

7 A. Yes, I believe I have.

8 Q. This document speaks to the Springfield
9 Plateau which is what we've been talking about;
10 correct?

11 A. Yes.

12 Q. Looking at the abstract, I wanted to direct
13 your attention to the -- be approximately the fourth
14 line up from the bottom of the abstract where it
15 starts "water from springs generally flows." Do you
16 see that sentence?

17 A. Yes, I do.

18 MR. GARREN: For the record, Your Honor,
19 I'm referring to Demonstrative 291. I don't think I
20 made that clear. I apologize.

21 THE COURT: Yes, sir.

22 Q. (BY MR. GARREN) It says -- I'll read it to
23 you -- "Water from springs generally flows rapidly
24 through large conduits with minimum water-rock
25 interactions. Water from wells flow through small

1 fractures which restrict flow and increase water-rock
2 interactions. As a result, springs tend to be more
3 susceptible to surface contamination than wells."

4 Do you agree with that principle or that
5 concept?

6 MR. MCDANIEL: Your Honor, this is
7 inappropriate cross-examination just to read from a
8 document that is not in evidence. It's not impeaching
9 an opinion that Mr. Larson has offered.

10 THE COURT: Sustained.

11 MR. GARREN: If I may respond just
12 briefly, Your Honor?

13 THE COURT: Go ahead.

14 MR. GARREN: The opinions with regard to
15 the groundwater that he's rendered in this case I
16 think are important with respect to how they interact,
17 and that this particular statement shows that the
18 contamination that you would see in a well would be
19 less and would be a basis for no correlation that
20 Mr. Larson was not able to find when he opined on two
21 or three of the exhibits that they entered into this
22 case.

23 It would follow that when you're tracing
24 concentrations through the gradients in the IRW of a
25 surface contamination, that that would be greater at

1 the surface but lesser as you go deeper which would be
2 in a groundwater well. And so I'm trying to build a
3 basis here to impeach his opinion that there is no
4 correlation when, in fact, you wouldn't expect to find
5 one.

6 THE COURT: Hold on just a second. Let
7 me just read what you said because I'm not sure I'm
8 following where you're going.

9 MR. GARREN: Okay. It takes awhile to
10 get there. I'm sorry.

11 THE COURT: Yeah. Mr. McDaniel, go
12 ahead.

13 MR. MCDANIEL: Yes, Your Honor. With
14 all due respect to Mr. Garren, his view of the
15 technical evidence is not really relevant to the
16 evidentiary procedural questions that's before the
17 court. In fact, what he just described impeaches his
18 own expert, not Mr. Larson, because Mr. Larson's here
19 because Dr. Fisher testified that the edge-of-field
20 samples and the groundwater samples blended seamlessly
21 together indicating that they're related to the
22 constituents.

23 So simply reading something from a document
24 suggesting that somehow it impeaches Mr. Larson is not
25 proper cross-examination without setting it up through

1 prior questions and answers from Mr. Larson.

2 THE COURT: As to the specific
3 objection, it is again sustained.

4 You may rephrase. Go ahead.

5 Q. (BY MR. GARREN) Would you agree with me,
6 Mr. Larson, that if you're looking at a surface
7 contamination, that generally speaking the
8 concentrations of that contamination will be greater
9 at the surface than they would be in groundwater? I'm
10 trying to limit that to the IRW too, sir. I don't
11 want to go astray on this.

12 A. Well, I think as a general matter, that may
13 be true. I don't know if it would always be true.

14 Q. So if you're trying to draw a correlation
15 with regard to certain chemical elements, there may be
16 less of a correlation as you go into the groundwater
17 at the groundwater depths that you might see in these
18 wells as opposed to those more near surface water such
19 as springs; correct?

20 A. Well -- well, first of all, when you look at
21 the movement of these elements through the subsurface,
22 as I think I testified in my direct testimony, the
23 relative amounts of these will change and the
24 relationships will change. That's one of the reasons
25 that, I think, you see a difference in the

1 relationships in the data.

2 In terms of springs being surface water, they
3 are surface water once they emerge from the ground.
4 Prior to that, the flow that emerges from those
5 springs is groundwater.

6 Q. Do you agree, sir, with the principle that
7 concentrations from a surface contaminant will
8 generally be greater at the surface levels than in
9 deep groundwater areas?

10 A. I would agree that concentrations nearer to
11 the source of the concentration -- or nearer to the
12 source of the contamination will typically be higher
13 than they are further away.

14 THE COURT: Mr. Garren, remind me, but
15 Dr. Fisher's groundwater samples came from wells?

16 MR. GARREN: Yes. And geoprobe. So we
17 have a combination of -- the materials that were used
18 in the data that Mr. Larson speaks to includes
19 springs, geoprobes, groundwater, and edge-of-field.

20 THE COURT: All right. Mr. Garren
21 basically is getting to this point that generally
22 interactions between surface -- or I'm
23 sorry -- materials in the soil and the water are
24 greater when you're dealing with water from wells as
25 opposed to water from springs because typically

1 springs are following those fractures and there's less
2 water surface interaction. When I say "surface," I
3 mean surface of the rock interaction. Obviously,
4 you're familiar with these sorts of dynamics.

5 What's your response?

6 THE WITNESS: Well, I think you got -- I
7 think you have to be cautious about the flow in the
8 fractures that, say, leach to a spring as to where did
9 this flow originate? Obviously, it all didn't
10 originate from infiltration right along the alignment
11 of the fracture. It was collected from broader areas
12 via smaller fractures.

13 So typically what will happen is you will
14 have recharge distributed over a larger area. That
15 will tend to flow toward, say, major fractures that
16 may provide easier pathways for the water to move, but
17 in getting there that water would have to go through
18 smaller fractures similar to what you might find in
19 wells.

20 Now, once it reaches, say, the major fracture
21 and if it's a collection of water, it may be moving
22 more rapidly and may have less rock-water interaction
23 along that portion of the pathway but that's only part
24 of the pathway. So I don't think you can draw a
25 general conclusion that just because it's emerging

1 from a spring it hasn't had much rock-water
2 interaction.

3 THE COURT: Once again going back to
4 your answer, you've got to look at -- to your previous
5 answer -- you've got to look at where the water's
6 coming from, where it's going, and it's not quite as
7 simple as only looking at fracturing.

8 THE WITNESS: That's absolutely
9 correct.

10 THE COURT: All right. Go ahead.

11 But you would agree with Mr. Garren's premise
12 that with regard to water coming from springs, at
13 least during a portion of its travel, there was less
14 interaction with rock and soil than generally found
15 with well water?

16 THE WITNESS: I would agree that, you
17 know, as it's collected along those fractures it may
18 tend to move more rapidly, and in that zone where it's
19 moving more rapidly there may be less interaction
20 before it emerges as water on the surface.

21 THE COURT: Okay. Go ahead, Mr. Garren.

22 Q. (BY MR. GARREN) Based upon your responses to
23 the judge, you're not disputing that the presence of
24 surface contaminants do reach the groundwater in wells
25 in the watershed, do you?

1 A. I don't know whether the contaminants have or
2 have not. I haven't -- the data I reviewed didn't
3 provide any evidence that it did, but I don't have a
4 conclusion whether it did or did not.

5 Q. And you've not studied it yourself
6 independently; correct?

7 A. That's correct.

8 Q. And when the company Apex was out visiting
9 various sites, they didn't collect any samples for you
10 to study on your own; correct?

11 A. That's correct.

12 Q. And were you aware there were split samples
13 provided to the defendants from the state's collection
14 of samples in the watershed?

15 A. I do recall something about that, yes.

16 Q. Did you analyze any of the data that was
17 provided to the defendants? Did they provide that to
18 you?

19 A. I'm sorry. Which data are you referring to,
20 the split samples?

21 Q. The split samples that may have been
22 provided -- that were provided from the state to the
23 defendants, were you provided that data set to
24 investigate?

25 A. I believe so. But I don't recall

1 specifically --

2 Q. It wasn't in your considered materials;
3 that's why I'm asking.

4 You only looked at Olsen and Fisher's work;
5 correct?

6 A. I did. But among the documents that I
7 reviewed were some reports associated with people who
8 accompanied some of the sampling, and I don't recall
9 offhand if there were descriptions in there of those
10 split samples or not.

11 Q. What I'm really trying to key to is, is that
12 there were split samples provided to the defendants.
13 Do you know whether or not analytics were provided --
14 or performed on those split samples?

15 MR. MCDANIEL: Your Honor, I want to
16 object a little bit. It's a little bit misleading,
17 Your Honor. Because as Mr. Garren knows, the
18 defendants did not get split samples of all the
19 groundwater samples they took, only those on the
20 subpoenaed poultry-grower's property. So I just want
21 to make sure the record is fair.

22 MR. GARREN: That's fine. And I agree
23 with that, Your Honor. I'm only asking whether or not
24 he's obtained any data from any of the split samples
25 that may have been provided to the defendants in this

1 case.

2 THE COURT: I understand.

3 A. I don't recall offhand.

4 Q. (BY MR. GARREN) Okay. Do you agree, sir,
5 that in identifying inputs to a watershed, that mass
6 balance can be a tool in understanding the nature and
7 source of contaminants?

8 MR. MCDANIEL: Clearly outside the
9 scope, Your Honor. This is not even a hydrogeologic
10 question.

11 THE COURT: Sustained.

12 Q. (BY MR. GARREN) All right. Based on your
13 testimony here today and yesterday, is it correct,
14 sir, that you're not providing any opinion as to the
15 effectiveness of any nutrient management practices in
16 the IRW?

17 A. That's correct.

18 Q. Now, you're familiar with the term "principle
19 component analysis," are you not?

20 A. Generally, yes.

21 Q. And do you agree that it's a
22 scientifically-accepted methodology for determining
23 source contamination?

24 MR. MCDANIEL: Your Honor, it's a topic
25 that is not even at issue in this trial, as well as

1 Mr. Larson hasn't offered any opinions about principle
2 component analysis. I don't understand why we're
3 spending time asking him if he's offering opinions
4 about things the man clearly did not offer opinions
5 about on direct.

6 THE COURT: Sustained.

7 Q. (BY MR. GARREN) Just so the record is clear,
8 you did not perform any such PCA analysis; correct?

9 A. I did not.

10 Q. Let's talk a little bit about outliers in
11 data collected.

12 Did you include all of the data when you did
13 your analysis?

14 A. Yes. All the data for those particular
15 sample results.

16 Q. All right. Let's talk now about your work
17 regarding Dr. Fisher's opinion and his correlations.

18 You agree that Dr. Fisher's opinion is based
19 on the correlation of the components when plotted
20 together; correct?

21 A. My understanding is that the correlation that
22 he drew was based on all the sample results grouped
23 together.

24 Q. Did you determine what were the constituents
25 of poultry waste in your work, sir?

1 A. Not specifically as part of my work.

2 Q. All right. And you didn't determine what
3 might have been the predominant chemicals found in the
4 poultry waste constituents; correct?

5 A. That's correct.

6 Q. I'm trying to get an exhibit number so we're
7 on the same page. Your figures 1 through 5 are
8 generally Defendants' Joint Exhibit 1624, 25, 6, 7,
9 and 8. In reference to those figures, let me ask you
10 some questions, sir.

11 What exactly was your hypothesis that you
12 were testing for when you isolated these chemical
13 components of the poultry waste?

14 A. I was investigating whether or not the
15 relationship that was exhibited in Dr. Fisher's figure
16 22 was the same when you looked at -- or similar when
17 you looked at the individual components or individual
18 groups of sample results separately.

19 As I think I testified during my direct, a
20 lot of the results for the groundwater samples have
21 relatively low concentrations, and so they're very
22 difficult sometimes to see whether or not they have
23 the same relationships. So I was testing whether that
24 relationship held for the individual sample groups.

25 Q. Because you isolated these chemicals, is part

1 of your hypothesis is that the surface water and
2 groundwater are not connected?

3 A. No. I isolated them because they represent
4 different types and groups of samples.

5 Q. Okay. You do agree then that surface water
6 and groundwater can be connected in the IRW, though;
7 correct?

8 A. In places it can be, yes.

9 Q. Did you perform what's referred to as a water
10 balance for your work in this case?

11 A. No, I did not.

12 Q. What did you do to determine what happens to
13 the water in the IRW after it enters the watershed?

14 A. May I amend that last answer?

15 Q. Sure.

16 A. I did look at in my report somewhat of a
17 water balance associated with individual wells to look
18 at how large of an area a well might draw its water
19 from.

20 Q. Other than that, you didn't perform any other
21 water balance; correct?

22 A. That's correct.

23 Q. All right. And tell the court just basically
24 what a water balance is.

25 A. Well, it's basically writing the statement of

1 inputs minus outputs equals the change in the storage.
2 You have a general balance statement like that. So
3 you'll accumulate all of the different components that
4 are inputs to a system, you will also accumulate data
5 for all the different components that are outputs, you
6 will subtract those two, and then you will see if the
7 difference represents the change in the accumulation
8 of the material within whatever system it is you're
9 looking at.

10 Q. Would you agree with me that's commonly a
11 first step when looking at water resources
12 contamination?

13 A. I don't think I can agree that it's
14 necessarily a first step. It may be done at some
15 point for various reasons, but I wouldn't agree that
16 it's necessarily a first step. It's often used in
17 water resource investigations. My experience is it's
18 not so common when you're looking at groundwater
19 contamination.

20 Q. So in looking at the water balance, it's
21 true, is it not, that there's basically only three
22 things the water can do when it reaches this
23 watershed. It can evapotranspire; correct?

24 A. Correct.

25 Q. It can infiltrate downward into the

1 groundwater; correct?

2 A. Correct.

3 Q. And then it can exit the exit point of the
4 watershed, which in this case would be the dam; right?

5 A. Well, it can discharge -- groundwater can
6 discharge to streams at certain points and become
7 surface water.

8 Q. Which eventually leads to the dam or the
9 lake, and then to leave the watershed it would have to
10 go through the dam; correct?

11 A. Well, as it goes through the watershed, it's
12 going to be exposed to, for example, evaporation from
13 the reservoir itself. So it's hard to judge where it
14 necessarily might go after it reaches the streams.

15 Q. There's no question but with regard to the
16 movement of water it moves downgradient -- is that a
17 fair statement? -- in this watershed.

18 A. Well, water, both surface water and
19 groundwater, move under the influence of gravity so
20 they'll tend to go downhill.

21 Q. And any contaminants in that water would
22 follow that flow path; correct?

23 A. They will follow a flow path. They may
24 interact, of course, along that flow path with the
25 materials that the water comes into contact with.

1 Q. Do you agree, sir, that concentration
2 gradients can identify pathways?

3 MR. MCDANIEL: Excuse me, Your Honor.
4 This is outside the scope. Mr. Larson didn't come
5 here to talk about fate and transport analysis, per
6 se. That's not part of his direct.

7 MR. GARREN: Again, I think it
8 undermines the premise from which he's drawing his
9 opinions, that he's failed or doesn't look at many of
10 these things in the IRW in order to draw such an
11 opinion.

12 MR. GREEN: Your Honor -- I'm sorry.

13 MR. GARREN: That's all right.

14 THE COURT: Just one second. Go
15 ahead.

16 MR. MCDANIEL: Mr. Garren is stating
17 what he thinks should be the elements or the premise
18 of Mr. Larson's work, and I think that's a flawed
19 statement in and of itself. But nonetheless, it needs
20 to come from the witness. In fact, what he's
21 describing now is gradient analysis and it's
22 Dr. Olsen's work, not Dr. Fisher's work.

23 MR. GARREN: Well, I would have to
24 disagree with that, Your Honor. I mean, that is the
25 premise with regard to Dr. Fisher's work, to show that

1 this relationship exists and that, in fact, his work
2 shows the concentration levels greater at the surface
3 and they get less as it goes deeper into the
4 groundwater and that there is a relationship.

5 THE COURT: Correct. Mr. Green.

6 MR. GREEN: I just have a quick
7 observation, Your Honor.

8 The questions that are being put to the
9 witness imply that Dr. Fisher did these things which
10 the -- which Mr. Garren is trying to see if Dr. Larson
11 did, and so we've flipped the analysis on its head
12 here.

13 I don't think there's any foundation for
14 Mr. Garren's question because there's certainly no
15 evidence in this case that Dr. Fisher did any -- did
16 any of this that's implicit in the question. So I
17 think the question is fundamentally unfair.

18 Number two, it's crystal clear --

19 THE COURT: Now, just to be clear, you
20 say you have a quick observation. Is this a -- number
21 one, is this an objection; number two, is it quick?

22 MR. GREEN: I'm sorry, sir. It is an
23 objection based on the lack of foundation in the
24 question, and it is crystal clear what the doctor
25 testified to. His opinions are well-marked out here

1 in this examination, and I think again I concur with
2 Mr. McDaniel that it's completely outside the scope.

3 THE COURT: I understand Mr. Garren's
4 point here. The objections are overruled.

5 Go ahead.

6 MR. GARREN: I think I need to have him
7 read back that question, Judge. I apologize.

8 THE COURT: Had to do with gradient
9 analysis. Just one second. The question was, do you
10 agree, sir, that concentration gradients can identify
11 pathways?

12 A. I think as a general matter, if you look at,
13 say, groundwater contamination and you have a
14 well-defined -- I'll call it plume of contamination,
15 that gradients may be helpful in identifying the
16 origins of the contamination.

17 Q. (BY MR. GARREN) And perhaps even a simple
18 example of that would be what's referred to as a dye
19 test, that if you put some dye in one area, trace it
20 to where it might end up, that kind of shows you a
21 pathway, does it not?

22 A. A dye test can be used to evaluate pathways.

23 Q. With regard to analysis of these data, you
24 would agree with me that a lesser number of data
25 points plotted will also lower a correlation among

1 that data?

2 A. No. I don't think I would agree that that
3 would necessarily be the case. It's possible but it
4 isn't necessarily -- the correlation is a function of
5 the degree to which in this case the line explains the
6 data, whatever it is. And so I don't think
7 necessarily just because you have fewer data points,
8 that you will lower the correlation.

9 Q. Is it true then, though, by separating data
10 into smaller sets, you run the risk of actually
11 lowering the correlations?

12 A. Not necessarily. The correlation is a
13 function of whatever the data are in terms of how well
14 they explain the variability in whatever the data is,
15 whether it's a fewer number of samples or more number
16 of samples. It's a statistical measure.

17 Q. All right. Let's talk a little bit about
18 what you do with nondetects in this case.

19 You agree that nondetects are a value
20 basically below a detection limit or reporting limit?

21 A. Yes. Basically, nondetects indicate that the
22 laboratory couldn't measure any of the substance at
23 that concentration.

24 Q. And sometimes these are referred to as
25 censored data; correct?

1 A. They can be, yes.

2 Q. Do you agree to actually analyze
3 environmental conditions that estimates of summary
4 statistics which best represent the entire
5 distribution of data, both below and above the
6 reporting limit, are necessary?

7 A. Could you repeat that, please?

8 Q. Yeah. Did you agree to accurately analyze
9 environmental conditions that estimates of summary
10 statistics which best represent the entire
11 distribution of the data, those both below and above
12 the reporting limit, are necessary?

13 A. Well, there are various statistical methods
14 for dealing with censored data, as you point out, and
15 summary statistics can include those data -- or should
16 include those data.

17 Q. Would you agree with me, sir, that there are
18 different methods of estimating summary statistics
19 when data includes less than -- or those nondetects as
20 we've called them?

21 A. There are different assumptions that can be
22 used about the nature of the nondetects in terms of
23 trying to compute these statistics.

24 Q. One of those methods would be referred to as
25 "the substitution method"; correct?

1 A. I don't know if it's called "the substitution
2 method." But basically, depending on what kind of
3 statistical analysis you're doing, if it's going to be
4 quantitative, you have to assume a value. For
5 example, if you're going to calculate regression
6 statistics or means or standard deviations, then you
7 have to assume a value for the nondetects.

8 Q. And basically what you're doing is, you're
9 substituting what is the data with a value that you've
10 assigned to it, correct, for your analysis?

11 A. No. I wouldn't characterize it that way. I
12 would say that for nondetects, a value has to be
13 assumed, either zero or some other value, depending on
14 your judgment about what to use for that value when
15 you make the summary statistics calculations.

16 Now, some statistics are not impacted by that
17 assumption. For example, nonparametric statistics are
18 things like -- well, basically nonparametric
19 statistics may not be effected.

20 Q. You didn't use those, though, in your
21 analysis?

22 A. Well, in a sense, the histograms that I
23 prepared are essentially that, because there we're
24 just -- the groups that are nondetects are all grouped
25 down at the lower end of the graphic so they're shown

1 basically separately. The remainder of the values
2 then are whatever those ratios were.

3 Q. But that's plotted against a log normal -- or
4 log scale; correct? Isn't that what you do?

5 A. It's not exactly. They're logarithmic
6 groups. And so because I'm not actually plotting on a
7 logarithmic scale, I can actually show the population
8 that goes from the zero to the first interval. That's
9 what I actually showed on my diagrams.

10 Q. Is it true, though, in using this method that
11 we've talked about -- and I'm using the term
12 "substitution" where you substitute a nondetect for
13 one of these assumed values -- that that can create
14 large gaps that do not appear realistic?

15 A. I'm not following your question about
16 substituting. When you -- when I did the
17 calculations, I used the nondetect values. I used
18 them as zeros and made my statistical calculations
19 based on that.

20 Q. Okay. And that's my point. You substituted,
21 by your choice, a nondetect with a zero value;
22 correct?

23 A. I used a value of zero. I mean --

24 Q. Well, you didn't use the actual data because
25 it's a nondetect; correct?

1 MR. MCDANIEL: Excuse me, Your Honor.

2 He cut the witness off. I would like him to have an
3 opportunity to finish his answer.

4 THE COURT: Sustained. Go ahead.

5 A. I used the nondetects. For purposes of the
6 calculation, I used a value of zero to represent the
7 nondetects.

8 Q. (BY MR. GARREN) So you substituted what they
9 would have been as a nondetect with a zero; correct?

10 A. Well, a nondetect is basically a result that
11 says the concentration is below some very low number,
12 and so I used zero to represent that number.

13 Q. Isn't it true that there are studies that
14 have determined that this substitution method that
15 you've used performs poorly in comparison to other
16 procedures?

17 A. I don't know specifically what you're
18 referring to.

19 Q. Are you aware of any studies that have
20 determined that using this substitution of the
21 nondetects with your zero choice value, that that is
22 in fact a -- that that method performs poorly in
23 comparison to other procedures?

24 A. I don't know if I could say necessarily
25 performs poorly. I think what -- what I would say is

1 that there are certain methods, nonparametric methods,
2 that are not potentially impacted by your selection of
3 the nondetect values as opposed to quantitative ones
4 which do have the potential to be affected.

5 Q. Do you agree, though, that substitution of
6 zero produces an estimate of the mean or median which
7 are biased low?

8 MR. MCDANIEL: I don't understand the
9 relevance, Your Honor. This is not relevant to the
10 analysis that Mr. Larson presented in his direct. He
11 didn't analyze medians and means. So how this
12 technique may be relevant to that isn't particularly
13 relevant to the analysis.

14 THE COURT: Well, I think the point is,
15 as I recall Dr. Fisher, he did not use zeros. He used
16 the lowest point of detection; correct?

17 MR. GARREN: Or, in fact, didn't use the
18 nondetects and used only that data that was, in fact,
19 a value.

20 THE COURT: Overruled. I should have
21 taken that statistics course back in college.

22 Go ahead, Mr. Garren.

23 Q. (BY MR. GARREN) I don't know that you
24 answered that question so if I may ask it again.

25 You agree that substitution of zero -- the

1 zero for nondetects produces an estimated mean or
2 median which are biased low?

3 A. I doubt that it would necessarily affect the
4 median, although it's possible. In terms of the mean,
5 it's possible it may have a slight bias in the mean,
6 although typically detection limits are quite low.
7 And so when you look at whether you, say, use the
8 value of zero or whether you used a value of half the
9 detection limit or the detection limit itself,
10 oftentimes it doesn't have much impact on that
11 statistic.

12 Q. But it can, can it not?

13 A. It's possible it can.

14 Q. Sure.

15 MR. GARREN: May I approach, Your Honor?

16 THE COURT: You may.

17 MR. GARREN: Your Honor, I'm going to
18 represent to the court that this is a 555-page
19 document. It is a defendants' exhibit. I do
20 have -- and it was reported as disclosed for this
21 witness. I have taken an excerpt and, in fact, I may
22 have a second one.

23 I'm happy to bring in 555 pages, Your Honor,
24 but I worry about the hernias that might occur as a
25 result of having to move it around. But I'm

1 prepared -- I do have a single copy of the entire one
2 here.

3 THE COURT: Thank you.

4 Q. (BY MR. GARREN) Mr. Larson, you recognize
5 this USGS -- I'm calling it a manual or book called
6 "Statistical Methods in Water Resources" that was in
7 your considered materials?

8 A. Yes, I do.

9 Q. And this is shown as Defendants' Joint
10 Exhibit 1617; correct?

11 A. Correct.

12 Q. I would direct your attention to -- and we'll
13 use the Bates number at the lower right-hand
14 corner where it says Exhibit 1617-0374.

15 Now, you would agree -- and, in fact, you've
16 testified -- that you've had training with the USGS;
17 correct?

18 A. That's correct.

19 Q. And this book is in part, I assume, utilized
20 by the USGS in teaching statistical methods in water
21 resources; correct?

22 A. I would assume, yes.

23 Q. Looking at that page 374 of this exhibit,
24 where it says in the paragraph below the figures
25 there, "Studies cited above determine that simple

1 substitution methods perform poorly in comparison to
2 other procedures," do you agree with that statement or
3 not, sir?

4 A. Well, I don't know if I can agree with it as
5 a general matter. It is possible that it could occur.

6 Q. All right. And it goes on to say,
7 "Substitution of zero produced estimates of mean and
8 median, which were biased low, while substituting the
9 reporting limit resulted in estimates above the true
10 values."

11 Do you see that statement?

12 A. Yes.

13 Q. Do you believe that to be a true statement?

14 A. It can be as I indicated. Not necessarily
15 but it can be.

16 Q. Did you, sir, perform any other computations
17 of more complex calculation to prove or show the
18 probability of the plotting procedures used by your
19 substitution method?

20 A. I did look at alternatives in terms of
21 whether I selected, for example, half the detection
22 limit or zero for those in terms of how they would
23 affect the general statistics.

24 Q. Did you perform what's referred to as a
25 maximum likelihood estimation?

1 A. No, I did not.

2 Q. Did you perform any probability plotting
3 procedures at all on the work that you did?

4 A. Yes.

5 Q. And what did you do?

6 A. Two of the exhibits that I showed you, the
7 histogram exhibits, are probability plots.

8 Q. Okay. Did you do any others?

9 A. No.

10 Q. And in doing the histograms --

11 A. Well, maybe I should qualify that. I didn't
12 present others. I did do others in some of my work.

13 Q. I'm sorry. Can you say that again?

14 A. I didn't present any others other than the
15 two histograms in my testimony. As part of my work, I
16 did do other comparisons.

17 Q. You agree that the choice of the value used
18 to substitute for the nondetects is arbitrary with a
19 person making that choice?

20 A. Well, it's a judgment that you make when you
21 deal with nondetects.

22 Q. Are you familiar with the distributional
23 method?

24 A. Not offhand.

25 Q. Okay. Looking at page 375 of this same

1 document under the heading "Distributional Methods,"
2 paragraph 13.1.2, do you see that?

3 A. Yes.

4 Q. And it says, "The use of characteristics" --

5 MR. MCDANIEL: Excuse me, Your Honor.

6 What is the purpose of reading from this document
7 that's not in evidence? It's not impeaching. He's
8 not refreshing the recollection. He's just reading
9 from the document.

10 THE COURT: Sustained.

11 Q. (BY MR. GARREN) All right. In your
12 criticism of Dr. Fisher, you did not use the
13 distributional method; correct?

14 A. I did not.

15 Q. I think you testified that there were, in
16 fact, quite a few nondetects in the various categories
17 of the samples, groundwater, springs, geoprobes;
18 correct?

19 A. In some of them there were, yes.

20 Q. And so if we were to look at your spreadsheet
21 for the underlying data, rather than seeing a blank,
22 you've put in a value of zero in order then to make
23 your analysis; correct?

24 A. To compute the summary statistics or the
25 regression statistics that I showed, yes, that's

1 correct.

2 Q. So under groundwater, it's my understanding
3 that there were 55 total samples, but in your work you
4 assumed 23 as zero; is that a fair approximation?

5 A. Those numbers don't ring a bell, no.

6 Q. Well, you talked about springs being 49 total
7 observations; correct?

8 A. Correct.

9 Q. And do you remember how many zeros you
10 assumed in your analysis for the springs?

11 A. Well, that depends on which element you're
12 looking at. I think for the zinc and the copper
13 concentrations something on the order of about 80
14 percent of them were nondetects.

15 MR. GARREN: If I may approach, Your
16 Honor?

17 THE COURT: Yes.

18 Q. (BY MR. GARREN) Mr. Larson, in order to help
19 refresh your recollection, I've pulled just a single
20 spreadsheet at random in your considered materials
21 that you used and I've highlighted some zeros and this
22 happens to do with zinc versus phosphorus.

23 Do you see that?

24 A. Yes, I do.

25 Q. And in the upper right-hand corner of this

1 document, you have what is shown as "ND=0." Does that
2 mean nondetect?

3 A. Correct.

4 Q. So as we look through -- this is, in fact,
5 part of your spreadsheet. If we look through this,
6 we'll see a number of pairs or individual zeros that
7 appear in your analysis; correct?

8 A. That's correct.

9 Q. And as I understand it, you agree that the
10 use of these zeros will create a bias to the low side
11 just as stated in the USGS handbook we looked at?

12 A. It can create biases on certain statistical
13 measures; it has that possibility.

14 Q. And would you agree that it would do so in
15 the analysis that you performed?

16 A. Not according to the evaluations that I did.
17 It didn't -- it didn't really matter whether I used
18 zero or half the detection limit in terms of assessing
19 the general trends or lack of trends in the data.

20 Q. Did you, in fact, use a running analysis on a
21 half limit for your detection for the nondetects as
22 opposed to zero?

23 A. I think at some point in time I did, yes.

24 Q. Is it in your considered materials?

25 A. I don't recall if I did it before my report

1 or after my report so it may or it may not. If I did
2 it before, it would be in my considered materials.

3 Q. Do you agree that Dr. Fisher's analysis with
4 regard to these components of poultry waste -- the
5 arsenic, zinc, copper, and phosphorus -- was in an
6 effort to try and track those waste constituents?

7 A. My understanding of the -- of Dr. Fisher's
8 analysis was to try to establish a link between the
9 concentrations found in the edge-of-field samples and
10 the concentrations found in the other samples, the
11 geoprobe, the spring, and the groundwater samples.

12 Q. And that is done in an effort to show
13 pathways, is it not?

14 A. No. I don't think there was any pathway
15 analysis that I'm aware of. It was basically just
16 looking at the relationships of the different data
17 groups.

18 Q. Well, you would agree with me, sir, that
19 poultry waste when it's removed from the barn is not
20 just dumped into groundwater someplace, is it?

21 A. Not that I know of.

22 Q. All right. And so when it's put on the
23 surface, in order to try and find whether or not
24 there's a pathway to these other water resources, the
25 geoprobe area, which is not quite as deep as the

1 wells, this would be a method for tracking those
2 constituents?

3 A. No, I don't believe it would be.

4 Q. All right. Now, as I understand, part of
5 your hypothesis is that it's different in that your
6 criticism of Dr. Fisher is that these constituents are
7 not good for tracing water; correct?

8 A. They are not good environmental tracers,
9 yes.

10 Q. Okay. But if we're trying to trace something
11 other than water and these are predominant
12 constituents of that other thing, that being a
13 contaminant, you would want to look for constituents
14 of the contaminant in order to trace its pathway,
15 would you not?

16 A. If you're looking for a contaminant, you
17 would analyze for the -- I don't understand that
18 question.

19 Q. You know, we have a premise that the
20 contaminant is poultry litter and it's comprised
21 predominant -- it has some predominant makeup of
22 arsenic, copper, zinc, and phosphorus. Do you agree
23 with that?

24 A. That's my understanding, yes. Or at least it
25 has some of those elements in it.

1 Q. Right. And so if you're trying to trace or
2 find pathways for that constituent through the
3 environment, you're not going to run a dye test to
4 show water path, are you?

5 A. Well, if you're looking for the path of the
6 water, that's one of the ways you actually do it.

7 Q. And, in fact, Dr. Fisher wasn't looking for a
8 path of water, he was looking for pathways related to
9 these constituents, wasn't he?

10 A. I don't recall, at least the portion of his
11 work that I reviewed in evaluation of pathways. What
12 I reviewed was an attempt to show a relationship
13 between groups of samples and that's what I analyzed.

14 Q. In your observations of the data, did you
15 determine that edge-of-field samples were higher in
16 phosphorus than found in the springs?

17 A. I think, generally speaking, if you look at
18 the concentrations, that edge-of-field samples had
19 higher phosphorus concentrations than the samples from
20 the springs.

21 Q. And did you find that the springs had higher
22 phosphorus levels than found in the wells?

23 A. I don't recall offhand. Let me check. I
24 don't know that they would necessarily be higher.
25 Some of them were higher.

1 Q. And so that I'm clear and the record's clear,
2 with regard to your criticisms of Dr. Olsen's work on
3 the house densities, you're not opining in any way
4 with regard to his analysis as to the surface water;
5 correct?

6 A. That's correct.

7 Q. And to the extent that these contaminants
8 when leaving the surface and making their way to the
9 groundwater may see lower concentrations, that may be
10 reasons for your not finding a correlation in your
11 analysis of the house density; correct?

12 A. When these materials, if they do leach into
13 the ground, they will interact with the rock and that
14 will change their compositions, and that certainly
15 could affect the concentrations that you see in
16 samples.

17 Q. You talked about the cattle edge-of-field
18 that was plotted and you mentioned it a couple of
19 times on a couple of your figures.

20 Do you know where that sample came from?

21 A. Not specifically, no.

22 Q. Did you do anything to try and verify the
23 source of that sample in all of the data that was
24 provided to you?

25 A. No, I did not.

1 Q. So you don't know that it came from Ed Fite's
2 property, do you?

3 A. I remember seeing a reference to that name,
4 but I didn't do any investigation of it.

5 Q. Okay. Did you make any investigation as to
6 what Ed Fite testified to in this case relating to the
7 use of his land where that sample was taken?

8 A. No, I did not.

9 Q. You don't know then that that sample may
10 have, in fact, been mislabeled, do you?

11 A. No, I do not.

12 MR. ELROD: Your Honor, I object. That
13 assumes facts not in evidence. That's the first time,
14 I take it, we've ever heard that in this court and I
15 don't think it came from the witness.

16 THE COURT: I think the objection comes
17 too late. Overruled.

18 Go ahead.

19 MR. GARREN: If I may have a moment,
20 Your Honor. I'm trying to get regathered here and --

21 *(Discussion held off the record)*

22 MR. GARREN: Why don't I take a moment,
23 Your Honor, and we can take our break, I think, for
24 the morning and regroup and --

25 THE COURT: Let's get over this hump.

1 Go ahead and take your break -- go ahead and take a
2 minute.

3 MR. GARREN: All right.

4 Q. (BY MR. GARREN) Did you make, Mr. Larson,
5 any consideration -- or take any consideration or
6 examination as to groundwater flows in your analysis?

7 A. Well, that's kind of a broad question. I did
8 make evaluations and some calculations, as I spoke
9 about earlier, about the size of the area that a
10 typical well might draw its water from. So in that
11 sense, yes.

12 Q. That's the only analysis you did, though;
13 correct?

14 A. That's the only quantitative analysis that I
15 did, yes.

16 Q. Did you make any determination or
17 investigation as to where waste was disposed of as
18 part of your analysis?

19 A. I didn't make any independent investigation.
20 I did in looking through the materials see maps
21 of -- that had been prepared by others of where that
22 might have occurred.

23 Q. With regard to the house density analysis you
24 did, you did not perform any statistical testing of
25 that to determine the validity of your analysis, did

1 you?

2 A. I'm not sure I understand the question. I
3 did compute statistics on each of the figures, and
4 that was the extent of the statistical evaluations
5 that I did.

6 Q. Did you compute any statistical measure of
7 the central tendency then?

8 A. I did look at some of the median
9 concentrations in some of the histograms that I -- I
10 should say ratios in some of the histograms that I
11 prepared.

12 Q. Did you compute a statistical measure of the
13 central tendency is what I'm asking you, sir?

14 A. Yes, I did. In my work, I did calculate the
15 medians for the populations that I presented in my
16 histograms.

17 Q. What was the statistical analysis that you
18 used or performed?

19 A. I took the median of the collection of values
20 of the different ratios that I computed and looked at
21 those medians.

22 Q. Are you familiar with the Wilcoxon test?

23 A. I'm familiar with a Wilcoxon rank sum test, if
24 that's what you're referring to.

25 Q. And you didn't perform that, did you?

1 A. I did at one time look at that to make sure
2 that visually what I saw -- and I'm not sure if I used
3 that particular rank sum test, but I did look at a
4 statistical test to make sure that what I saw on the
5 histograms was statistically appropriate; in other
6 words, that there were significant differences in the
7 populations that I portrayed on the diagrams.

8 Q. Is that statistical analysis in your
9 considered materials, sir?

10 A. It should have been.

11 MR. GARREN: I'll pass the witness, Your
12 Honor.

13 THE COURT: Very well. Let's take our
14 recess.

15 MR. MCDANIEL: I was going to tell you
16 that we have no redirect, if you would -- if that's of
17 use to you.

18 THE COURT: Very well. You may be
19 excused.

20 THE WITNESS: Thank you.

21 *(Short break)*

22 THE COURT: The defendants may call
23 their next witness.

24 MR. TUCKER: Dr. Billy Clay, Your
25 Honor.

1 MR. MCDANIEL: Your Honor, I was just
2 going to ask you, would it be any trouble for the
3 court if I was excused at about five minutes to
4 twelve? I've got a client matter I need to --

5 THE COURT: That would not bother the
6 court at all.

7 The other thing I need to alert you to is
8 that I've had an eye appointment for about a year set
9 for 4:15 tomorrow. So we'll need to adjourn to give
10 me enough time to get out to 101st and Harvard or
11 something like that because you all are presenting
12 enough briefs that my eyes need a new prescription.

13 **BILLY R. CLAY, DVM,**
14 ***after having been first duly sworn, says in reply to***
15 ***the questions propounded as follows, to-wit:***

16 THE COURT: Sir, if you'll please state
17 your full name for the record.

18 THE WITNESS: Billy R. Clay.

19 THE COURT: Mr. Tucker. Mr. Tucker,
20 you'll be pleased to know that the court's just been
21 reassigned the Arrow Trucking case this morning as
22 well. Lucky me.

23 MR. TUCKER: Well, you'll have to do
24 that one all by yourself, Your Honor. I'll take care
25 of your SemGroup case for you.

1 THE COURT: Okay.

2 MR. TUCKER: I hope.

3 **DIRECT EXAMINATION**

4 **BY MR. TUCKER:**

5 Q. May it please the court, Dr. Clay, would you
6 tell the court something about your education.

7 A. Yes, sir. I'm a graduate of a high school
8 just south of here and a B.S. and M.S. at Oklahoma
9 State University in agricultural sciences with an
10 emphasis on agronomy, later a DVM degree, and then a
11 certification -- a board certification in veterinarian
12 toxicology.

13 Q. And where did you obtain your veterinary
14 medicine degree?

15 A. Also at Oklahoma State University.

16 Q. Now, we've had several comments in this
17 courtroom about the recent football contest that
18 Oklahoma State University played for three quarters
19 and we don't need to go back into that. So we are
20 just going to talk about the educational aspects of
21 the university, if you please.

22 A. I don't care to comment about the football.

23 Q. What is required to become board-certified in
24 veterinary toxicology?

25 A. Well, it requires a study -- a period of

1 study of at least five years post-DVM degree and then
2 an application to the examining board for it
3 credentials, and after approval by credentials then
4 setting for an exam, take the exam, which
5 involves -- it can involve both written and oral.

6 Q. It's been said that there is a direct
7 relationship between the amount of education a person
8 receives and the likelihood that that person goes on
9 to teach. Did that saying apply to you?

10 A. Well, I have taught, but only as a part of my
11 history.

12 Q. Well, tell me about your teaching experience,
13 if you would.

14 A. Well, as a -- as the study of agronomy, I was
15 a graduate assistant, a National Science Foundation
16 graduate assistant, and I taught forage crops. That
17 was a course for undergraduates pertaining to the
18 establishment of forages -- or actually pastures and
19 range. It was a pasture and range study.

20 Then while I was working on my board
21 certification, I taught at the College of Veterinary
22 Medicine. Again, I taught things predominantly
23 related to food animal or herbivorous animal, which
24 included the consumption of forages. I also taught
25 some others too. I also taught a section in

1 toxicology.

2 Q. Did you have any teaching experience in
3 agronomy?

4 A. Yes. That was the earliest one I mentioned.
5 It was in agronomy as a graduate assistant, National
6 Science Foundation graduate assistant.

7 Q. Are agronomy and veterinary medicine
8 disciplines that are related?

9 A. Well, very much so.

10 Q. Could you tell us how?

11 A. Yes. Agronomics pertain to both crops and
12 soils, and crops include forages for livestock. A
13 veterinarian's focus is the health and management of
14 livestock as well as those, of course, that graze the
15 forages so it's important to understand the things
16 they eat.

17 Q. Okay. Does that also include the behavior of
18 livestock?

19 A. That is a part of it, yes.

20 Q. Are you a member of any professional
21 societies?

22 A. Yes, I am.

23 Q. Could you tell the court what societies you
24 are a member of?

25 A. Well, locally I'm a member of the Oklahoma

1 Veterinary Medical Association, nationally the
2 American Veterinary Medical Association, the Academy
3 of Veterinary Consultants, the Crop Science Society of
4 America, American Society of Agronomy, Soil Science
5 Society of America. There are some others. But
6 American Board of Veterinary Toxicology and American
7 Academy of Comparative Toxicology.

8 Q. Tell me about your other employment other
9 than teaching.

10 A. Well, I've been employed at varied ways. I
11 did some work for the Oklahoma Agricultural Experiment
12 Station. I did work for -- I've done work for
13 pharmaceutical companies and I've done work for many
14 different private enterprise entities.

15 Q. What kind of work did you do for
16 pharmaceutical companies?

17 A. Most of that work was research and
18 development work for the purpose of developing
19 pharmaceuticals, and it was gathering data to submit
20 to the Food and Drug Administration for approval of
21 pharmaceuticals.

22 Q. Have you been to the Illinois River Basin
23 before?

24 A. Yes, I've been there.

25 Q. Starting when?

1 A. Many years ago, 40 or more.

2 Q. Before even this lawsuit began?

3 A. Long before.

4 Q. About how many times would you estimate
5 you've been to the basin over your lifetime?

6 A. I couldn't really estimate it because it's
7 been -- I've been there many, many times.

8 Q. Have you testified off and on through the
9 years as an expert witness?

10 A. Yes, I have.

11 Q. Have you done consulting for companies in
12 connection with matters relating to the environment?

13 A. I have.

14 Q. Have you done consulting for companies in
15 matters relating to your specialties of toxicology,
16 veterinary medicine, and agronomy?

17 A. I have in all respects, yes.

18 Q. Did you agree to be a consultant and
19 ultimately a witness for us in this case?

20 A. I did.

21 Q. Would you tell the court generally what your
22 primary task was that we asked you to look at for this
23 case?

24 A. Yes. You were interested in having
25 characterization of the watershed from the

1 agricultural production point of view, and in
2 particular, single out the predominant species of
3 animals that were there and the land usage pertaining
4 to the production of those animals.

5 Q. Were you asked to evaluate the numbers of the
6 predominant animals in the watershed?

7 A. Yes.

8 Q. And you understand that this lawsuit has to
9 do with allegations of manure and phosphorus?

10 A. Yes.

11 Q. Were you asked to make evaluations of the
12 predominant species in the watershed and their
13 production of manure and phosphorus?

14 A. Yes. To make estimates of those.

15 Q. Were you asked to compare those with other
16 animals other than the predominant species that are
17 present in the basin?

18 A. Yes, that's true.

19 Q. Is that true as well?

20 A. Yes, that is true.

21 Q. Were you also asked to consider the behavior
22 of cattle in the Illinois River Basin?

23 MR. GARREN: Your Honor, it's leading.

24 THE COURT: Sustained. Rephrase,
25 please.

1 MR. TUCKER: Surely, Your Honor.

2 Q. (BY MR. TUCKER) Did any of your assignment
3 have to do with cattle?

4 A. Yes. There was some specific requests about
5 cattle relative to understanding how they function in
6 the watershed, which did include behavior.

7 Q. How are you qualified to discuss behavior of
8 cattle?

9 A. Well, I have lots of experience there as well
10 as education pertaining to behavior. The experience
11 starts as a child in which I was given assignment in a
12 ranch setting to protect a herd of cattle that were
13 grazed in the lowlands.

14 Q. When you say "a ranch setting," what does
15 that mean?

16 A. Well, that means it was predominantly forage
17 and cattle. In this case, it was more than just
18 cattle; there were other livestock. But I had the --

19 Q. Who gave --

20 A. -- cattle responsibility.

21 Q. Who gave you the assignment?

22 A. Well, the assignment was actually given by my
23 father.

24 Q. Is that where you lived?

25 A. And it wasn't by request; it was mandated.

1 Q. Well, tell me what you -- what that
2 assignment has to do with qualifying you to talk about
3 behavior of cattle.

4 A. Well, we had a rather unique setting. We
5 were in a watershed setting in which we -- there was a
6 stream that frequently flooded and in the spring and
7 the fall it was a real issue.

8 A large proportion of the pasture on this
9 property was in the lowlands, and so it was necessary
10 for me to monitor as my assignment. If the weather
11 was likely to result in rainy weather, it was my
12 obligation to get the cattle out of the lowlands, take
13 them across the stream to the highlands.

14 Q. All right. And were the cattle always in the
15 lowlands?

16 A. Well, they were when we put them there. But
17 the important thing there was that I -- I may have to
18 go retrieve them any time of the day depending on what
19 the weather forecast is and really my time
20 availability.

21 Because it was from day to day, it might be
22 morning, it might be noon, it might be late in the
23 afternoon, and there have been occasions at night as a
24 matter of fact. So over time I was able to determine
25 where to expect to find the cattle. I knew from their

1 behavior where to find them.

2 Q. Okay. And generally where would you expect
3 to find them? You said at different times of the day.
4 When did you -- where did you learn to expect to find
5 cattle?

6 A. Well, if it were morning, up to about 10:00,
7 10:30, I could find them scattered out across the
8 pasture. If it were from 6:00 to 8:00 in the evening,
9 I could also find them scattered across the pasture.
10 Anytime in between, I found them in the shade and/or
11 near water or in water if it were spring, summer,
12 fall.

13 Q. In your years since that early assignment, as
14 you put it, have you had an opportunity to continue to
15 observe the behavior of cattle?

16 A. Yes. And, of course, in the course work that
17 I was required to take in order to become an
18 agronomist who had some specialty in forages, it was
19 necessary for me to understand the behavior of the
20 animal as well as a veterinarian it was important that
21 I understand the behavior of the animal.

22 So I had training that confirmed what I
23 already knew. And in addition to that, I spent a
24 couple of years on a dairy prior to the education and
25 I learned behavior of dairy cattle as well.

1 Q. And I'm assuming that you consistently
2 thanked your father for that early assignment which
3 led you to the study of veterinary medicine?

4 A. Well, it was a contributor, no doubt. And
5 yes, I did thank my father.

6 Q. Did you determine the size of the land mass
7 of the Illinois River Basin?

8 A. Yes.

9 Q. How large is it?

10 A. About 1.1 million acres.

11 Q. Did you determine how much of the land in the
12 basin is devoted to farming and agricultural
13 production?

14 A. Yes.

15 Q. How did you go about doing that?

16 A. Using the agricultural census, which is a
17 voluntary completion of the census forms from the USDA
18 in which farmers will fill those out. And it -- they
19 report how many acres they use that are involved in
20 their farming operation.

21 Q. And did you say that's sponsored by the
22 federal government?

23 A. Yes. It's the U.S. Department of
24 Agriculture. They have a branch called the National
25 Agricultural Statistic Service.

1 Q. How often is that census completed?

2 A. Five years. Five-year intervals.

3 Q. What is the purpose of the census?

4 A. The purpose is for the U.S. Department of
5 Agriculture to monitor trends in production,
6 agriculture, as well as land usage.

7 Q. Would you look in your notebook to
8 Defendants' Joint Exhibit 505, please?

9 A. I have it.

10 Q. What is Defendants' Joint Exhibit 505, if you
11 can tell us?

12 A. This is the -- a copy of the census form,
13 yes.

14 Q. Is that a blank form?

15 A. Appears to be a complete copy of the -- of
16 the census form for 2002.

17 Q. Is that the year that you used?

18 A. That is the year that I used.

19 MR. TUCKER: Your Honor, the defendant
20 would offer Defendants' Joint Exhibit 505.

21 THE COURT: Any objection?

22 MR. GARREN: None, Your Honor.

23 THE COURT: Defendants' 505 is admitted.

24 Q. (BY MR. TUCKER) Now, you say you used the
25 census data to make your analysis about how much of

1 the land in the basin is devoted to farming and
2 agriculture and you said you used the 2002 census.

3 Why did you use the 2002 census if they're
4 completed every five years?

5 A. Well, at the time that I was assigned to do
6 the work that I was doing, this was the most recent
7 census that was available.

8 Q. When is the 2002 census actually published
9 and made available to folks to work with?

10 A. Well, in late 2003 or early 2004, you could
11 expect to get the bulk of the data. At the zip code
12 level, it would have been somewhere in 2004.

13 Q. How is the data presented?

14 A. The data is presented in --

15 Q. That's a poor question. Let me rephrase the
16 question.

17 Does the data -- when the data's presented
18 for people to have access, are you looking at
19 individual census forms or tabulations of the census
20 forms?

21 A. No. It's a summary tabulation that the
22 statistic service provides.

23 Q. And when you look at that, are you able to
24 make any geographic determinations of how the data's
25 presented?

1 A. No. Other than county level or possibly zip
2 code level.

3 Q. And is it presented that way in the reports?

4 A. In the reports, they present it at the state
5 level, the county level, and the zip code level.

6 Q. And the zip code is the smallest unit that's
7 available?

8 A. That's correct.

9 Q. Does the farm census include information
10 about land use?

11 A. Yes.

12 Q. Is it mandatory to complete this census?

13 A. No.

14 Q. Now, the next most recent census would have
15 been the 2007 census?

16 A. Correct.

17 Q. Is it even completely available now to the
18 zip code level?

19 A. I suspect that it is. I have not checked,
20 but it was not -- it was not available in late 2008.
21 So it would have been somewhere in early 2009, if it
22 was all available.

23 Q. And when was your report submitted, sir?

24 A. In -- in early 2008.

25 Q. All right. The census, when it breaks these

1 things down by zip codes, is it reported by river
2 drainage basin?

3 A. No.

4 Q. So it doesn't separately call out the
5 agricultural uses within the Illinois River Basin?

6 A. I may need to correct something. I said my
7 report was in 2008. I believe it was in 2009, wasn't
8 it? I've forgotten the date on it. I'm sorry.

9 Q. Time flies, Dr. Clay, when you're having fun.

10 A. I just can't remember the date on it.

11 MR. TUCKER: If I may, Your Honor, it's
12 dated November 29, 2008.

13 A. Okay. Thank you.

14 Q. (BY MR. TUCKER) So to get back to the
15 question I was asking, does the census report by river
16 basin?

17 A. No.

18 Q. How did you determine the use of land areas
19 in the basin using zip codes in the census if it
20 doesn't report by river basin?

21 A. Well, I had a zip code map in both electronic
22 as well as hard copy, and I was able to overlay that
23 on -- onto the watershed map and determine percentage
24 of zip code that relies -- or did lie within the
25 watershed.

1 Q. Is that a reliable method to make that
2 analysis in your opinion?

3 A. I believe it is.

4 MR. GARREN: Objection, Your Honor;
5 foundation. This gentleman is a toxicologist,
6 veterinarian toxicologist. He's not an ag engineer.
7 He's not an ag economist. He doesn't have the
8 authority or expertise to testify to that.

9 THE COURT: Sustained.

10 Q. (BY MR. TUCKER) Can you read a map,
11 Dr. Clay?

12 A. Certainly can.

13 Q. What is a zip code map?

14 A. A zip code map is nothing more than a
15 rendition created by the postal service that shows
16 where they deliver the mail and it is broken into
17 sections with defined boundaries.

18 Q. Do zip code maps bear any relationship to
19 whatever you call a map that you put up on the wall?

20 A. Do they vary?

21 Q. To a road map. For example, does a zip code
22 map bear any relationship to a road map?

23 A. Well, you could see a road map -- you could
24 overlay a road map on a zip code map, and many of them
25 are for that matter, so that you can see the roads as

1 well as the zip codes.

2 Q. On zip code maps, are geographic
3 characteristics like cities and rivers shown?

4 A. Sure.

5 Q. And in your work in agronomy, have you worked
6 with watershed maps before?

7 A. Well, yes. I've worked with a variety of
8 maps, topographic maps, actually road maps, section
9 line maps. Typically, everything that we deal with in
10 my business is based on identifying property, at least
11 at the section level, township, and range. Of course
12 those overlay very well on zip codes also.

13 Q. When you say "overlay," would you be more
14 descriptive as to what that means?

15 A. Well, it means if you can acquire maps of
16 similar dimensions, you can overlay them, particularly
17 electronically, and in turn determine their
18 relationship to one and the other.

19 Q. Is that kind of a map available for the
20 Illinois River Basin?

21 A. Yes.

22 Q. Does the zip code map for eastern Oklahoma
23 and zip code map for western Arkansas include the
24 Illinois River Basin?

25 A. It does.

1 Q. Were you able to find maps of consistent size
2 that permitted you to overlay those areas?

3 A. Yes.

4 Q. What was the purpose of overlaying those
5 areas?

6 A. To determine which portion of the zip code
7 did lie within the watershed.

8 Q. Did zip code lines neatly correspond with
9 watershed boundaries?

10 A. No.

11 Q. Were some zip codes entirely within the
12 watershed?

13 A. Yes.

14 Q. Were some zip codes entirely outside the
15 watershed?

16 A. Well, many, of course.

17 Q. As to those zip codes that were within the
18 watershed that did not neatly correspond within the
19 boundary lines, what did you do to make a
20 determination as to the percentage of land in a zip
21 code that was inside or outside the boundaries of the
22 Illinois River Basin?

23 A. We did a standard --

24 MR. GARREN: I object to the form, Your
25 Honor. I don't know whether we're talking about a

1 hard map; that is, a paper map, or whether we're
2 talking about an electronic version.

3 THE COURT: Overruled. Go ahead.

4 A. The -- we used a standard method. And the
5 standard method was that -- we used a 25, 50, 75, 100
6 on a percentage basis of zip code that was present or
7 not present.

8 Q. Is that a method which was unique and
9 developed for this lawsuit?

10 A. Yes.

11 Q. Had you ever done that before?

12 A. I hadn't done that before.

13 Q. Is it a hundred percent accurate?

14 A. No.

15 Q. Would you consider it to be generally
16 reliable for the purposes of the investigation that
17 you made?

18 MR. GARREN: Object, Your Honor.
19 There's been no foundation with regard to his ability
20 to testify to the reliability. In fact, if you'll
21 listen to his testimony, he said that we did this, he
22 didn't do it.

23 THE COURT: Overruled. It's for the
24 court to determine reliability.

25 Q. (BY MR. TUCKER) Dr. Clay.

1 A. Please repeat that.

2 Q. I'll try to do something close to it.

3 Do you believe that that method of
4 determining what percentage of the -- if you call them
5 the boundary zip codes, where the land mass was inside
6 or outside the watershed, was reliable for use for
7 your purposes in determining generally the amount of
8 agricultural uses of this million-some-odd-acre
9 watershed?

10 A. Yes. In that I was interested in an
11 estimate. I knew I could not get the precise number
12 to begin with.

13 Q. How many agricultural-use acres did you
14 calculate in the watershed as reported in the census?

15 A. 698,000 were tabulated.

16 Q. About what percent is that?

17 A. Well, it's approximately two-thirds of the
18 watershed.

19 Q. Did the ag census capture all the acres
20 devoted to farming?

21 A. No.

22 Q. How do you know that?

23 A. Well, I also did an assessment of the
24 property owners that exist in the watershed in which I
25 tabulated the number of property owners that owned

1 five acres or more. That total number of property
2 owners was considerably more than was reported.

3 MR. GARREN: Your Honor, I'm going to
4 object to this line of questioning. Again, we have an
5 agronomist and veterinarian toxicologist, and he's
6 opining on matters and things that he has not
7 established any experience, education, or foundation
8 for.

9 THE COURT: Overruled.

10 Q. (BY MR. TUCKER) How did you perform that
11 exercise, Dr. Clay?

12 A. Used the county plat books as well as a map
13 that was identified at the section level.

14 Q. Are county plat books something you have used
15 before in your work in agronomy?

16 A. Many times. Not only agronomy but other
17 places.

18 Q. I appreciate -- in this courtroom we're
19 probably all clear about what a plat book is, but
20 there's been a suggestion that this case may end up
21 someplace else eventually. If that were so, those
22 persons might not be familiar from their jurisdiction
23 with the term "plat book." Would you explain it?

24 A. Yes. Each of the county seats will maintain
25 a record of property ownership within the county, and

1 within that they keep a book that shows the property
2 owners which in most cases includes a map.

3 Q. And then you mentioned a section map?

4 A. Yes. If you -- if you have a map of the
5 watershed that has the section numbers on it,
6 township, and range, it's possible to correlate those
7 directly.

8 Q. In doing that, did you make an approximation
9 of the number of property owners in the basin?

10 A. Yes.

11 Q. Would that include homeowners or just or some
12 other classification?

13 A. Well, it would be property owners of property
14 of five acres or greater. We purposefully did not go
15 less than that.

16 Q. Why not?

17 A. Because we know that there would be lots of
18 lot-sized properties in the watershed. There would
19 also be several people that liked to buy one acre or
20 two acres for their house.

21 Q. Approximately how many such property owners
22 did you locate in the basin?

23 A. About 6 -- excuse me -- about 11,000.

24 Q. And of that 11,000, how many of those
25 property owners identified them to the census group as

1 being engaged in farming?

2 A. About 4500.

3 Q. Does the census have any information to
4 report on the use that those 6500 other property
5 owners are making of their property?

6 A. No.

7 Q. All right. In the course of your
8 investigations in this file and for us, did you make
9 any other on-site investigations in the basin?

10 A. Yes. Several personal tours as well as
11 communication with a variety of people within the
12 basin, particularly county extension directors, area
13 directors, NRCS folks.

14 Q. What's an area director?

15 A. In the extension service, the people have
16 assignments that cover particular points of interest
17 in an area as opposed to just a county. In other
18 words, they may have multiple counties in which they
19 have a responsibility for.

20 Q. That category of people that you have just
21 discussed -- let me ask this question another way.

22 Is there a category of people in counties
23 that tend to have the most information about farming
24 activities and agricultural activities within their
25 counties?

1 A. The ones I just mentioned would have the most
2 information at the local level.

3 Q. Dr. Clay, what did you determine to be the
4 predominant land use of the land that was devoted to
5 farming?

6 A. It's for pasture for livestock, or at least
7 forages for livestock.

8 Q. Did you using the census consider how that
9 pasture or how that livestock land was actually used
10 and broken down?

11 A. Well, I used the -- or I collected the data
12 from the census that shows their allocation of those
13 uses, yes.

14 Q. I'd like you to turn to -- and if you'd pull
15 up please -- Tyson Demonstrative 262. Could you
16 explain what Demonstrative 262 is, please, Dr. Clay?

17 A. Yes. This is the summary from the --
18 tabulated summary of the information collected from
19 the census. They categorize it in the permanent
20 pasture for cattle, and then they show hay and
21 harvested forages, and then they show forages that are
22 planted, typically annually, for grazing, and then
23 woodland pastures.

24 Q. Let's start at the top, if you would. And I
25 can see soybeans, corn, and wheat, but let's start at

1 permanent pasture cattle. And would you define or
2 explain what the census means when they talk about
3 permanent pasture cattle?

4 A. Well, in the category of asking the people
5 filling out the census is that they identify permanent
6 pasture, meaning this is -- this is designated for one
7 use. In most cases, that is a perennial plant that's
8 planted in the -- on that land and it is used for
9 cattle.

10 Q. And the cattle would be expected to occupy
11 that pasture year-round; is that right?

12 A. That's correct.

13 Q. Now, the second category is hay/harvested
14 forage. Would you explain that category?

15 A. Yes. That's land that is devoted to the
16 production of hay or to production of forages that
17 could be harvested in various ways. Could be made
18 into silage. Could be made into various other
19 forms.

20 Q. Now, with the hay/harvested forage, we're
21 contemplating there that hay will be harvested or
22 baled; is that right? Or silage will be collected and
23 baled?

24 A. Well, silage won't be baled but hay would be
25 baled, yes. Generally, that's the case.

1 Q. Can you tell whether the hay that's harvested
2 there will be fed to cattle on that property?

3 A. No.

4 Q. Can it tell you whether the cattle -- whether
5 that hay will be sold and consumed within the basin or
6 outside the basin?

7 MR. GARREN: Leading, Your Honor.

8 THE COURT: Overruled. It's "can it
9 tell you." It's not leading.

10 Go ahead.

11 A. It cannot tell you where it will be used.

12 Q. (BY MR. TUCKER) Would the same be true for
13 silage?

14 A. That is correct.

15 Q. Would you explain forage for grazing?

16 A. Yes. In that there are some stocker cattle
17 in this area -- that's lighter-weight cattle or
18 growing cattle -- and then there are a fair number of
19 dairies, they plant pasture on an annual, basis and
20 some of it is overseeded and others as well, so that
21 planting is what would be forage for grazing.

22 Q. All right. Now, how is that different than
23 permanent pasture?

24 A. Well, permanent pasture comes back from the
25 base of the plant or the crown, if you will, every

1 year regardless of frost. These plants usually
2 terminate their growth -- they have a growth cycle
3 that ends within a year.

4 Q. Would you give some examples of what forage
5 for grazing crops would be?

6 A. Small grains are typically used, wheat, oats,
7 rye, barley, rye grass, sudangrass, millet, things of
8 that nature.

9 Q. And the fourth category, woodland pastures,
10 would you define that for us, please?

11 A. That is part of -- part of the property
12 owner's land that they -- that is forested, yet they
13 use it for pasture for cattle.

14 Q. In other words, the cows can get in between
15 the trees to graze?

16 A. Correct.

17 Q. Of those categories -- permanent pasture,
18 harvested, forage, and woodland pastures -- are
19 woodland pastures susceptible to being fertilized by
20 anything, chemical fertilizer or poultry litter or
21 anything else?

22 A. Not very easily.

23 Q. Why is that?

24 A. Well, as it says, it's woodland pasture and
25 generally you have to have equipment access in order

1 to apply fertilization. It could be done but it would
2 be much more difficult. It would require hand
3 application.

4 Q. Did you reach a conclusion as to whether the
5 ag census fully explains and accounts for all
6 agricultural use of land in the basin?

7 A. Well, no, it doesn't. But it makes an
8 estimate.

9 Q. And how does it -- how does it miss the mark,
10 if you believe it misses the mark?

11 A. Well, as pointed out earlier, I know that
12 there's an additional 6,000 property owners there with
13 acreage five or greater that do not report to the
14 census so they do something with their land. And
15 so --

16 Q. Do you know of any of those owners,
17 particularly that have had cattle on their land, that
18 fit in that category?

19 A. Well, through recent conversation, I learned
20 of one.

21 Q. Who is that?

22 MR. GARREN: Objection; hearsay. Not
23 established also whether we're talking about the IRW,
24 Your Honor.

25 THE COURT: Sustained.

1 Q. (BY MR. TUCKER) From reading the transcript
2 in this case, Dr. Clay, did you learn of an individual
3 in this courtroom who does not report to the census
4 but who raises cattle and has more than five acres?

5 A. Yes.

6 Q. Would you identify that person, please?

7 A. Mr. John Elrod.

8 Q. But as you said, it's not mandatory to
9 report; is that correct?

10 A. That's correct.

11 Q. Why is it that people don't report, if you
12 know?

13 A. Well, they have a variety of reasons for not
14 reporting so I can't tell you why an individual would
15 not report. I perhaps could tell you why Mr. Elrod
16 didn't report.

17 MR. TUCKER: I apologize, Your Honor. I
18 did kind of set that one up for him.

19 THE COURT: The IRS is no longer with
20 offices in this building.

21 Q. (BY MR. TUCKER) Did you -- Dr. Clay, did you
22 study the type of cattle production that normally
23 occurs in the basin?

24 A. Yes, I did.

25 Q. What did you find is the type of cattle

1 production that predominates?

2 MR. GARREN: Objection; foundation.
3 What he did to do that.

4 MR. TUCKER: Well, Your Honor, I think
5 what he said earlier was he conversed with the various
6 people in the counties who were most knowledgeable as
7 well as personally going through the watershed. But
8 there's also one other thing that we could add to kind
9 of move that along.

10 Q. (BY MR. TUCKER) If we could turn, Dr. Clay,
11 to Defendants' Joint Exhibit 505 -- I think it's 505.
12 Well, actually I'm going to do that later.

13 So let me just go back to saying that the
14 basis of the types of cattle usage that are in the
15 basin was originally determined I think -- well, let
16 me ask you this: How did you determine it?

17 A. Well, I have a lot of experience with cattle
18 production in Oklahoma and Arkansas for one thing.
19 The other is that in communication with the county
20 extension directors and area extension directors, I
21 got additional information.

22 Q. What experience do you have with cattle
23 production before you got to this case?

24 A. Well, I described some of it earlier. And
25 then of course in order for me to continue my studies

1 over the years, I was interested in cattle in
2 particular, although I'm interested in all the
3 livestock.

4 So I studied what Oklahoma's cattle
5 production looks like, if you will, not once, but many
6 times. I've looked at the Arkansas cattle production
7 as well as other livestock production, not once, but
8 many times. I have communicated with university
9 personnel in both the University of Arkansas and
10 Oklahoma State University pertaining to cattle
11 production there. I've read numerous pamphlets,
12 pieces of research, pieces of information pertaining
13 to livestock production in general in those states.

14 I feel comfortable that I know what the
15 business is in general.

16 Q. Are there any earth-shattering differences
17 between cattle production that occurs in the Illinois
18 River Basin and cattle production that occurs
19 elsewhere in eastern Oklahoma?

20 A. No. And not -- I mean, it's just terrain.
21 You know, there's places in western Oklahoma that
22 would be different, different kinds of forages, but
23 basically they're the same.

24 Q. All right. What did you find about the
25 cattle production that occurs generally in the basin?

1 A. There are three types of -- or groups of
2 cattle that you can expect to find there. You find a
3 cow-calf operation, which is -- the sole purpose of
4 that business is to produce a baby calf that raises up
5 to weaning weight, which is about generally 210 days,
6 approximately 500 pounds, and that is the item that is
7 sold from that property and that's the sort of income.

8 The other beef cattle operation is called a
9 stocker operation. That's a situation in which either
10 on planted forages, or permanent pasture in many
11 cases, folks will buy wean-age cattle with the
12 objective of growing them to a level whereby they
13 could be placed in feed yards, and that's generally
14 from the 500-pound range up to about 800 pounds, and
15 then sell them and send them on to the feed yard.

16 In that operation, that is their business.
17 So they set a group of cattle in, raise them to that
18 level, sell them, replace them with a new group of
19 cattle, and so on and so on.

20 And then there is the dairy operation. There
21 are -- there are dairies in both Arkansas and Oklahoma
22 within the Illinois River Watershed. The dairy
23 operation in this case is typically a forage-based
24 operation, although they have to have feed imported,
25 and their primary business of course is the production

1 of milk. Now, they do produce calves but the calves
2 generally are not an important economic part of their
3 business except for the heifers that they would save
4 for replacement.

5 Q. Now, let's go back to the cow-calf.

6 You indicated that the cow-calf operation
7 sells the calves off each year; right?

8 A. Yes, that's right.

9 Q. Does the cow-calf operator sell anything else
10 off besides the calves?

11 A. Well, they have to sell the cull cows and/or
12 the cull bulls.

13 Q. What are cull cows and cull bulls?

14 A. Well, the life of a beef cow is about eight
15 years, and so they have to plan to replace that beef
16 cow every eight years. So that means that on an
17 annual basis, they'll be culling some percentage of
18 the cows, typically at ten percent, if you will, cull
19 on an annual basis. And so those culls will either go
20 on pasture for -- so that they can put some weight on
21 and hit a better market condition, or they'll be sold
22 directly from the place and sent to the sale barn or
23 wherever they're sold.

24 Q. And you say that the working span of a cow is
25 about eight years?

1 A. Yes. That's the productive life of a cow.

2 Q. What is the productive life of a bull?

3 A. About four years.

4 MR. GARREN: Relevance, Your Honor, with
5 regard to the productive lives of cattle.

6 THE COURT: Relevance?

7 MR. TUCKER: Your Honor, it's important
8 to know how many cattle are on the land. For example,
9 if you replace a bull every four years, you can't just
10 pick up a bull from your neighborhood and say, would
11 you drop on by on Friday night. You got to be able to
12 have a bull on stream coming along. The same thing
13 with heifers. You have to have replacement heifers.

14 So we're talking about total numbers of
15 animals which leads to totals amounts of manure which
16 leads to total tons of phosphorus.

17 MR. GARREN: He's also testified that we
18 have a census of that and he's knowledgeable of the
19 census. He understands that his use of that is solely
20 as an estimate. I don't see the relevance in the
21 detail that we're getting into, Your Honor.

22 THE COURT: Yeah. What's the relevance
23 of the background here?

24 MR. TUCKER: The relevance is is because
25 the way the census reports, if all cows all weighed a

1 thousand pounds, then all you'd have to do would be to
2 add things up, but all cows don't all weigh a thousand
3 pounds. So you have to determine what the cow
4 population and the cattle population consists of in
5 order to make the next step which is how much manure
6 which leads to how much phosphorus.

7 THE COURT: Overruled.

8 Q. (BY MR. TUCKER) With regard to heifers, if
9 you cull -- if you cull a cow in eight years, what is
10 the -- how do you replace the cow that you're
11 culling?

12 A. Well, it really takes a portion of two
13 heifers, if you will. You have to have a portion of a
14 heifer that's approaching the calving age, which is
15 two years, and then you have to have a heifer that is
16 lightweight coming on. So that's the way it's done.
17 They tend to have a heifer saved back each year that
18 is going to contribute to that replacement.

19 Q. Did you determine the approximate number of
20 cattle total in the watershed?

21 A. Yes.

22 Q. And what is that?

23 A. About 200,000 head.

24 Q. How did you use the census data to calculate
25 those numbers -- or that number?

1 A. The census reports cattle as in different
2 categories, reports it in inventory of beef cows, as
3 well as other cattle, and then it has sales data as
4 well.

5 So I used the inventory as a primary source,
6 because cattle that are there the entire year are the
7 primary contributors to the manure and/or phosphorus
8 that exists there. So I picked out the cattle that
9 would be there the entire year, made an estimate of
10 those, the estimate of the manure that they produce,
11 as well as the phosphorus that's present in the
12 manure.

13 MR. TUCKER: Could you pull up for me
14 Defendants' Joint Exhibit 505, page 0011?

15 Q. (BY MR. TUCKER) And that's going back to the
16 blank census form, Dr. Clay. It's page 0011 of our
17 exhibit numbers. It's identified here as section 10
18 of the census form.

19 Could you look at the first half of that
20 which relates to inventory and explain that -- how
21 that -- those questions are asked and what they mean
22 to your analysis?

23 A. Yes, sir. It has the categories under
24 inventory of -- it has three categories at the top of
25 that -- or top of the page -- top half of the page.

1 And the first one is the beef -- excuse me -- total
2 number of cattle and calves on hand; then beef cows,
3 including beef heifers that have calved; milk cows,
4 both dry and/or milking cows; and then all other
5 cattle after that.

6 Q. I noticed, for example, other cattle includes
7 heifers, steers, calves, and bulls.

8 A. Yes.

9 Q. Well, those clearly aren't -- don't all weigh
10 the same, do they?

11 A. No.

12 Q. And they clearly would not all produce the
13 same quantity of manure?

14 A. No.

15 Q. Would it have been possible just to take the
16 total of those four and say this is how we're going to
17 calculate manure in the basin?

18 A. It is possible to do that.

19 Q. How do you do that?

20 A. Well, what I did was, in fact, use the --

21 MR. GARREN: Objection, Your Honor;
22 foundation again. We have a toxicologist who's now
23 going to give us an accounting or an economist opinion
24 or point of view, and he's not qualified nor does he
25 have -- has he testified to any education, skills, or

1 training specifically with regard to this kind of
2 economics opinion.

3 THE COURT: All right. Insofar as this
4 is a continuing objection, any response here,
5 Mr. Tucker?

6 MR. TUCKER: Your Honor, the man's a
7 veterinarian. He starts dealing with cattle manure
8 from the time he walks in the first day of his
9 clinical practice.

10 THE COURT: Overruled.

11 A. Okay. Where were we, sir?

12 Q. (BY MR. TUCKER) Well, I think I was asking
13 you, were you able to calculate the total tons of
14 cattle manure deposited in the basin each year?

15 *(Discussion held off the record)*

16 A. Yes.

17 Q. (BY MR. TUCKER) And what did you determine
18 to be the total tons of cattle manure deposited in the
19 basin each year?

20 MR. GARREN: Objection, Your Honor. I
21 think a foundation is necessary to show what he did to
22 do that.

23 THE COURT: Sustained.

24 Q. (BY MR. TUCKER) All right. Tell me what you
25 did to determine the amount of manure produced by

1 cattle in the basin.

2 A. I looked at the cattle there that were going
3 to be there year-round and made an estimate of the
4 amount of manure that each cow unit would -- would
5 produce, as well as the stocker units would produce,
6 and applied the American Society of Agricultural
7 Engineers' manure characteristics and content -- or
8 production and content for phosphorus and made those
9 calculations accordingly.

10 Q. Is that American Society of Agricultural
11 Engineers data material something that you normally
12 use in your capacity as a veterinarian?

13 A. Yes, I've used it before.

14 Q. For how many years?

15 A. Several.

16 Q. And based upon that, what did you calculate
17 to be the total tons of cattle manure deposited in the
18 basin each year?

19 MR. GARREN: Your Honor, I'm going to
20 object again because he hasn't testified that, in
21 fact, the use of that data is for purposes, as we see
22 here in this court, that he's made these calculations.
23 He's drawn it from sources that typically a
24 veterinarian would not use, applied some kind of
25 economics to it.

1 His answer was to a question about how much
2 manure is produced, and he answered it, well, I've
3 calculated phosphorus. None of this sets the proper
4 foundation.

5 THE COURT: Overruled. It's subject to
6 cross-examine.

7 Go ahead.

8 Q. (BY MR. TUCKER) Dr. Clay.

9 A. Could I hear it again? I'm sorry.

10 Q. Well, let's just start over.

11 You've told us that this ASAE material is
12 something that you normally used as a veterinarian?

13 A. Yes. Is that the question?

14 Q. Is that correct?

15 A. That is correct.

16 Q. And is that customarily used by other
17 veterinarians in their practice?

18 A. Yes. And, in fact, veterinarians are very
19 much concerned about the economics of a productive cow
20 herd because their entire business depends upon the
21 economic survivability of the owner of the cow. So
22 it's important to use those data and understand it.

23 Q. I guess if the rancher doesn't survive,
24 neither does the veterinarian.

25 A. That is correct.

1 Q. And I want to ask you about manure. That's
2 all we're talking about right now.

3 Did you use those materials to determine the
4 amount of manure that's produced by all the cattle in
5 the basin each year?

6 A. Yes, yes. The cattle that I considered to be
7 year-round survivors.

8 Q. And what did you calculate that to be?

9 A. The number?

10 Q. Yes.

11 A. I believe that was about 233,000 dry tons per
12 year.

13 Q. What is the difference between a dry ton and
14 a wet ton?

15 A. Well, of course a wet ton is as the weight is
16 produced. In other words, when an animal excretes the
17 manure, it is wet and drops right on the ground.

18 Q. And the dry ton would be after the water has
19 evaporated or otherwise gone away?

20 A. Or by knowing the amount of dry matter that's
21 typically in cattle manure, one can make an estimate
22 of the dry weight, and that is what I did.

23 Q. Did we ask you to determine, the best you
24 could, in your capacity as an expert the number of
25 tons of poultry manure produced in the basin each

1 year?

2 A. Yes.

3 Q. Were you able to do so?

4 A. Yes.

5 Q. Explain how you determined that tonnage.

6 A. The tonnage again was based on the number of
7 birds that was determined to be in the watershed from
8 the census data and then using a similar approach as I
9 described earlier. First of all, how much do the
10 different kinds of birds produce on a daily basis and
11 then how much phosphorus is present in that manure.
12 So both of those calculations can be made.

13 Q. All right. Now, are zip codes a hundred
14 percent accurate for poultry?

15 A. No.

16 Q. And would you tell us some of the
17 shortcomings of using the zip code method for
18 calculating the numbers of poultry in the basin?

19 A. The census data is guaranteed by the census
20 people to be confidential. In order to make it
21 confidential at the zip code level, if there's only
22 four producers there, they won't report it at the zip
23 code level.

24 Q. For example, with regard to chickens, do you
25 know if that had an effect in this watershed?

1 A. It did.

2 Q. Explain that to the court, please.

3 A. There was some of the chickens -- chicken
4 operations that were not reported. Or excuse me.
5 Yes, the chicken operations that weren't reported.

6 Q. All right. Do you know of any in particular?

7 A. Well, one in particular that was pointed out
8 to me is Butler Farms.

9 Q. And is Butler Farms not reported?

10 A. It is not reported in the census.

11 Q. Is Butler Farms' production a significant
12 number of birds?

13 A. Yes, it is.

14 Q. How large is it?

15 A. About six million birds.

16 Q. All right. And what about with regard to
17 turkeys; are there gaps in the poultry counts using
18 zip codes?

19 A. There are gaps in the turkeys too.

20 Q. Okay. And about what would that gap be?

21 A. That's about two million birds.

22 Q. Now, would it have been better to use sales
23 figures?

24 A. Well, no. It wouldn't have been reported
25 either.

1 Q. Would it have been better -- all right.

2 Do you know whether Mr. Butler's litter was
3 applied in the basin?

4 A. No, it was not. It was shipped out.

5 Q. After you delivered your original report, did
6 you prepare and subsequently deliver an errata?

7 A. I did.

8 Q. And what kinds of changes were made?

9 A. There was some -- some spreadsheet changes
10 where there were some errors and those were identified
11 and corrected.

12 Q. Is your testimony here based upon the
13 original report or the errata?

14 A. On the errata.

15 Q. And did you -- you said you did determine the
16 number of tons of poultry manure produced in the basin
17 each year. What number did you reach as the probable
18 number?

19 A. I think that was about 210,000 tons dry
20 weight.

21 Q. With regard to the number of birds in the zip
22 code method, you understand that witnesses for the
23 state used other methods to determine the numbers of
24 poultry; is that correct?

25 A. Yes.

1 Q. At the end of the day, what was the
2 percentage difference between the numbers of poultry
3 totaled using your method as compared to the method
4 used by the state witnesses?

5 A. Less than one percent difference.

6 Q. All right. Does it make any difference
7 whether manure is wet or dry when you're trying to
8 determine how much phosphorus is contained in manure?

9 A. No.

10 Q. Did you determine the amount of phosphorus
11 that is in cattle manure?

12 A. Yes.

13 Q. Would you tell us what method you used to do
14 that?

15 A. As I explained earlier, I used the 2003 ASAE,
16 the Society of -- American Society of Agricultural
17 Engineers. They have phosphorus produced on a
18 thousand-pounds-body-weight basis daily, and I used
19 those numbers.

20 Q. Are these regularly-published numbers that
21 are used in your profession?

22 A. Yes.

23 Q. It's like a standardized text reference?

24 A. It is a reference.

25 Q. Now, you say it's so much production of

1 phosphorus per thousand pounds. A thousand pounds of
2 what?

3 A. Body weight.

4 Q. And how did you make that determination? Is
5 that just for phosphorus or is that for manure as
6 well?

7 A. For manure and phosphorus.

8 Q. So how did you relate the thousand pounds of
9 body weight to the fact that we have different kinds
10 of animals under the classification of cattle?

11 A. Well, ultimately convert it to a thousand
12 pounds to make the comparison. But in order to get
13 there, you have to use each class of animal to make
14 those calculations independently.

15 Q. And did you do that?

16 A. Yes.

17 Q. And how did you reduce those to
18 thousand-pound units?

19 A. First calculated as to what they would
20 represent in total. In other words, a basic economic
21 unit would represent so many animal units and -- or
22 portions of animal units and then convert it to
23 thousand-pound units.

24 Q. Is that the practice that's customarily
25 followed in your profession?

1 A. Yes.

2 Q. And using that, did you determine the amount
3 of phosphorus in the cattle manure that's deposited in
4 the basin each year?

5 A. I did.

6 Q. And what is that amount?

7 A. About 3100 tons.

8 Q. Did you make a determination of how much
9 phosphorus is in the manure produced by poultry in the
10 basin each year?

11 A. I did.

12 Q. How did you determine that?

13 A. In a similar fashion.

14 Q. Now, we've had jokes about the thousand-pound
15 chicken. Is that -- is that -- and it seems kind of
16 silly. But is that the way you have to calculate it
17 in order to be talking about apples and apples?

18 A. Well, if you're going to use the guide books,
19 it's based on a thousand pounds and that makes it
20 simple, or relatively simple.

21 Q. So we gather together a thousand pounds of
22 chicken and calculate it that way?

23 A. Correct.

24 Q. And based upon that, about how much
25 phosphorus is in the manure produced by poultry in the

1 basin each year?

2 A. Also about 3100 tons, slightly more.

3 Q. Now, just to be clear, are tons of litter the
4 same thing as tons of poultry manure?

5 A. No.

6 Q. Quickly if you might explain the difference
7 just for the record.

8 A. Well, manure is that which is excreted from
9 the bird directly onto the bedding, then the bedding
10 and the manure together become the litter.

11 Q. And the same is true with regard to cattle
12 manure, isn't it, that the tons of phosphorus in
13 cattle manure is not the same as thinking of the -- of
14 the chunk of cow manure on the pasture?

15 A. Restate that, if you would, sir.

16 Q. Well, in other words, a cow patty is not
17 composed entirely of phosphorus obviously?

18 A. Oh, absolutely not, no. It's the water. The
19 dry components are the solids, if you will, and the
20 solids would have in it phosphorus.

21 Q. Did you determine how much of the phosphorus
22 in the poultry manure produced in the basin is
23 available to potentially be applied in the basin?

24 A. Yes.

25 Q. And what was that amount?

1 A. Well, that -- that's -- what I did was
2 calculate the amount that was exported, and that left
3 a number of -- I've forgotten what the number is
4 exactly after export. It's in my -- I think it was
5 about 2900 tons or 2800, something like that. I can't
6 remember exactly.

7 Q. How did you determine the amount of manure
8 that was exported from the basin?

9 A. There was an accounting made of exported
10 manure from the Illinois River Watershed from about
11 2005 through 20 -- well, currently, and I took the
12 last three years of that data which was available to
13 me.

14 Q. And that tabulation was made by what
15 organization?

16 A. BMP, Inc.

17 Q. How much phosphorus would be in 70,000 tons
18 of exported litter?

19 A. About 750 pounds -- excuse me -- tons. 750
20 tons of phosphorus in 70,000 tons of litter. And
21 70,000 tons we're talking about is wet weight, by the
22 way.

23 Q. Is it possible that some litter with manure
24 may have been imported to the basin?

25 A. Sure.

1 Q. Is it possible that some litter may have been
2 exported that was not included in your export total?

3 A. Sure.

4 Q. Is there any way to tell what those numbers
5 will be?

6 A. Probably not without a subpoena.

7 Q. Is there any certainty that 70,000 tons wet
8 weight will continue to be exported?

9 A. No.

10 Q. Did you make a determination of the amount of
11 phosphorus produced by other animals and deposited in
12 the basin each year?

13 A. I did.

14 Q. How did you do that?

15 A. Following a similar method as before
16 using -- using the census. But in the case of
17 wildlife, I had to use other methods to do that, and
18 much of that information I was able to acquire through
19 recent TMDLs that have been filed.

20 Q. What does other animals consist of?

21 A. Well, it's swine, deer -- well, deer in the
22 case of wildlife, horses, sheep, ducks, geese, wild
23 turkeys.

24 Q. And the domestic animals, I gather, were
25 reported in the census?

1 A. Yes.

2 Q. But wildlife is not?

3 A. That's right.

4 Q. So for that, what data do you use?

5 A. I relied on data from the wildlife services
6 from both states.

7 Q. Taken together, what did you find insofar as
8 the -- well, did you take that calculation on down and
9 also determine the amount of phosphorus that those
10 animals produced from their manure?

11 A. Yes.

12 Q. Using the same methods as you've described
13 before?

14 A. Yes. In the case of the wildlife, though, as
15 I said, I got the guidelines from the TMDLs.

16 Q. What did you find as to the total for other
17 animals approximately?

18 A. About 950 tons of phosphorus.

19 Q. Okay.

20 MR. TUCKER: If we could pull up
21 Demonstrative 263.

22 Q. (BY MR. TUCKER) Would you tell the court
23 what that is intended to show?

24 A. This is a table from my report, and it shows
25 the dry mass -- the summary of the dry mass or dry

1 weight of the manure of all of the classes of animals
2 that I made calculations on.

3 Q. Now, let me interrupt you at this point.

4 For beef cattle, you show 217,000 and for
5 poultry you show 157,000. I thought you told us that
6 the total amounts of manure were about the same?

7 A. I did. But this is -- this has the export
8 taken out of it.

9 Q. So that is net of BMP's 70,000 tons?

10 A. It is net of BPM.

11 Q. All right. And then does this chart also
12 demonstrate the amount of phosphorus contained in that
13 manure?

14 A. Yes. It's shown in the fourth column --
15 well, actually fifth column from the left.

16 Q. And for other animals, would you identify in
17 this sheet, just so we have it clear, which of the --
18 which of the lines relate to other animals?

19 A. Hogs and pigs, horses and ponies, whitetail
20 deer, sheep and lambs, while turkeys, wild geese and
21 ducks.

22 MR. TUCKER: Please pull up
23 Demonstrative 265.

24 Q. (BY MR. TUCKER) Could you tell us what is
25 that intended to illustrate, please, Dr. Clay?

1 A. This is a bar graph to illustrate the
2 phosphorus production for all cattle, poultry, poultry
3 after export compared to all other animals.

4 Q. And I see two columns for poultry. Is
5 one -- one says "less exported" and one just says
6 "poultry."

7 A. The one that says "poultry" is production,
8 what phosphorus is produced on an annual basis of the
9 poultry in the watershed. That is produced. It
10 doesn't say what happens to it. Likewise with the
11 cattle.

12 Q. So when you reduce it down to its base
13 question here in this courtroom, which is phosphorus,
14 it looks like, as far as production is concerned, that
15 cattle and poultry is roughly equivalent?

16 A. Yes.

17 MR. TUCKER: Please pull up
18 Demonstrative 266.

19 Q. (BY MR. TUCKER) And could you explain, just
20 for illustrative purposes, what you intend to show
21 with this?

22 A. Well, in this case, it shows the cattle again
23 at 3136. It shows the poultry less exported. So
24 that's poultry litter that is available for
25 application to the watershed.

1 Q. Now, why do you say "available"?

2 A. Well, we don't know whether it is applied
3 because something else could be done with it. It's
4 available. I have no record of whether it's applied
5 or not.

6 Q. As a part of your analysis, did you determine
7 whether poultry-growers apply all their litter in
8 their houses every year?

9 A. Well, poultry-growers certainly don't.
10 Poultry-growers, if they have cattle in pasture, they
11 may apply some.

12 MR. GARREN: Your Honor, I'm going to
13 move -- I object to this. We don't have a foundation
14 where he's getting his poultry information and --

15 THE COURT: Sustained. Let's take our
16 recess for lunch.

17 *(Lunch recess was taken)*

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C E R T I F I C A T E

I, Brian P. Neil, a Certified Court Reporter for the Eastern District of Oklahoma, do hereby certify that the foregoing is a true and accurate transcription of my stenographic notes and is a true record of the proceedings held in above-captioned case.

I further certify that I am not employed by or related to any party to this action by blood or marriage and that I am in no way interested in the outcome of this matter.

In witness whereof, I have hereunto set my hand this 5th day of January 2010.

s/ Brian P. Neil

Brian P. Neil, CSR-RPR, CRR, RMR
United States Court Reporter